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ABSTRACT

This collection of reprints offers practical solutions, not readily available elsewhere, to everyday energy problems, such as high utility bills, insulating windows, getting more gas mileage, or buying a more efficient washer or refrigerator. The Arkansas Energy Office provides a weekly column of energy news and conservation tips to newspapers, trade journals, company newsletters, and interested individuals. Selected columns are provided in the first section. Topics include: industrial oil recycling/management; conservation in small business; conservation in farming; recycling; firewood; automobile conservation; electricity users; the envelope home; heat-pump efficiency; heat pumps; electric blankets; conserving natural gas; solar house plans; turbine vents; air-conditioners; and indoor pollution. The next sections provide information/tips on appliance energy conservation (washers, refrigerators, stoves, clothes dryers, air-conditioners, and dishwashers) and Energy Guides, followed by tips originally published by other states. These include science fair ideas, school tips, an energy checklist for buying a home, energy conservation in a rural home, the Audubon Energy Plan, and sample Energygrams published by Technical Information Center of the U.S. Department of Energy. Instructions for constructing a mobile home greenhouse, window insulation directory and addresses of state energy offices are also provided. (Author/JN)

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Arkansas Energy Office

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1982

Frank White
Governor

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INTRODUCTION

Old remedies and modern inventions designed to deal with the Energy Crisis -- all borrowed -- are published in this volume of the Energy Resource Kit supplied to Arkansas libraries by the Arkansas Energy Office. While other volumes provide references to published sources, this collection of reprints offers practical solutions to everyday problems, such as high utility bills, or insulating windows, or getting more gas mileage, or buying a more efficient washer or refrigerator, which are not readily available elsewhere.

Much has been printed about the Energy Crisis and potential solutions, and some of the best items have not been circulated broadly. This volume reprints useful material to supply tips to those interested in energy conservation and wise use of resources at home, on the road, and in business.

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ARKANSAS ENERGY OFFICE

The Arkansas Energy Office provides a weekly column of energy news and conservation tips to newspapers, trade journals, company newsletters and interested individuals, as a public service. Reprinted below are columns containing information not readily available elsewhere. To arrange to receive columns regularly, call the Energy Hotline: 1-800-482-1122 or write:

Public Information Coordinator
Arkansas Energy Office
One State Capitol Mall
Little Rock, Arkansas 72201.

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INDUSTRIAL OIL RECYCLING AND MANAGEMENT
By The
Arkansas Energy Office

The control of consumption and proper handling of used industrial lubricants is increasing in importance. This is due to the escalating prices of all petroleum products and the requirements of "cradle-to-grave" accounting of all hazardous materials set forth in the Resource Conservation and Recovery Act of 1976 (RCRA).

Through the proper management of industrial oils, plants may realize many benefits:

A. Decreased volume and cost of new oil
B. Decreased volume of waste and cost of waste transportation
C. Reduced need for pollution control
D. Reduced volume of waste which may be considered hazardous under RCRA
E. Good company public relations
F. Energy conservation
1. Btu's inherent in the oil
2. Indirect conservation
a. Refinery process energy and cost
b. Transportation
c. Packaging
d. Waste hauling

In the recycling of industrial oils, there are two basic approaches that an industry may take. In the first approach, used oil may be segregated and stored for pickup by a commercial hauler who transports the oils to a re-refinery or reprocessing facility. However, if the quantities of oil generated are substantial, it may be cost-effective to establish in-house recycling facilities. These facilities may include steps such as settling, centrifuging, filtration and dehydration of the used oil.

Starting Your Own Oil Recovery System

To start a used oil management and recycling program in an industry, it is necessary to first audit and track oil consumption and disposition. This step may be accomplished by development and implementation of uniform record-keeping, reporting, and oil-use accounting. An oil-use survey should be conducted. Employee support and participation should be sought.

Purchase vouchers for oil may be checked against used oil leaving the plant for disposal or recycling. After you have this data, you may categorize mixtures of oils, and match the oil with appropriate methods of treatment. After the appropriate treatment method has been identified, cost of implementation and operation may be determined. From this information, the economic returns of an in-plant recovery program may be calculated. After you have successfully performed this cost-benefit analysis, you may assign priorities to projects based on investment merit, and plan your in-plant oil recovery program.

In order to obtain good data, it may be necessary to obtain external assistance for making recommendations.

Importance Of Good Maintenance

The importance of a good maintenance program cannot be over-emphasized. For

example, if we were dealing with a fire-resistant fluid, such as a phosphate ester, and had a leakage loss of just one drop per second, this would amount to over $2,454 per year, at current prices.

If you have large volumes (several hundred gallons) of used industrial or automotive oil and wish to have them collected and recycled, please call one of the following used oil collectors:

Carter Oil Service
North Little Rock, AR
945-7848

Oil Recovery, Inc.
Little Rock, AR
372-0938

Oil Service Co.
Little Rock/Fayetteville, AR
378-3924

Taylor Waste Oil
Pine Bluff, AR
945-2229

Currently, used oil is selling for from 11 to 30 cents per gallon.

For further information, contact:

Arkansas Energy Office
One State Capitol Mall
Little Rock, AR 72201
371-1370 (Little Rock)
1-800-482-1122 (toll-free, state)

American Petroleum Institute
2101 L Street, NW
Washington, DC 20037
(202) 457-7016

U. S. Department of Commerce
National Bureau of Standards
Recycled Oil Program
Washington, DC 20034

(October, 1981)

CONSERVATION IN SMALL BUSINESS

By the Staff of the Arkansas Energy Office

Entrepreneurs in Arkansas are getting a helping hand from retired executives working through the Service Corps of Retired Executives (SCORE), which offers advice on business management practices and cost-cutting measures to help keep a business afloat.

Much of the time that business advice includes methods of using less energy, to control ever-rising utility bills. SCORE volunteers use energy-management manuals prepared by national trade associations in various fields in their work. The volunteers work through the Little Rock office of the federal Small Business Administration.

Auto dealerships could save significantly by changing to low-energy lighting, inside and outdoors, according to the manual *Saving Energy Costs in Your Dealership* published by the National Automobile Dealers Association.

Electricity for lighting could be cut 10 to 15 percent, according to the manual, without any loss in quality of lighting. One dealership that switched to energy-efficient bulbs, and removed some lights altogether, spent $1,327 and saved $18,120 over a 10-year period.

Other measures suggested for auto dealers included lowering thermostats in buildings after hours; keeping closed large garage doors or even installing automatic door-closers; insulating pipes and tanks in hot-water and steam systems; adding economizers to air-conditioners to use outside air whenever suitable; switching to outside air whenever suitable; switching to outside air for air-compressor intakes; turning off gas pilot lights in summer; and turning off unneeded equipment to reduce the demand peak.

The American Retail Federation advised store

managers to install energy-efficient lighting, and to take advantage of heat-control measures that could save 20 to 40 percent. This included setting the thermostat to 45 degrees in non-working hours, reducing the heat loss through display windows and keeping the winter store temperature between 65 to 68 degrees.

The Institute of Real Estate Management advised apartment managers to save hot water by installing aerators on sinks and showerheads, reducing thermostats on hot-water tanks, and installing timers on hot-water circulating pumps.

The International Fabricare Institute advised drycleaners to insulate all pipes and to service boilers once a year to keep them at peak efficiency. Keeping steam traps in good repair saved one plant $1,960 in a year's time, in exchange for $8 worth of repair parts, according to the trade energy manual.

The Small Business Administration recommends keeping a record of monthly energy use and expenditures, to keep track of the effects of routine practices, and changes made to save energy. The agency provides a handy form for keeping such a record.

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For More Information, Call the Arkansas Energy Office: 1-800-482-1122

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CONSERVATION IN FARMING

By the Staff of the Arkansas Energy Office

Agriculture is an important part of the Arkansas economy and that means that energy efficiency is important to agriculture.

Proper insulation and temperature controls offer the greatest savings to all farming enterprises.

Poultry farmers should fill in all cracks in brooder houses, and install insulation in the walls and ceilings. Heating systems should blow warm air down on the poultry, rather than across the ceiling.

Engines should be maintained carefully; badly-fouled spark plugs can increase gas consumption as much as six to 10 percent. One study concluded that 46 percent of all tractors studied were improperly adjusted, so this represents an important opportunity to conserve fuel and save money.

Storing fuel properly is another energy-saving practice. Almost 10 gallons a month can be lost from dark-colored fuel tanks above ground. Painting the tank white and shading it may cut losses to about 2.4 gallons a month. A pressure release valve on a white, shaded tank could bring that loss to 1.3 gallons a month. Underground tanks cut losses even more.

Cutting down on the time that an engine is allowed to idle may save as much as two percent of the total spent on energy.

Dampers placed on building roof ventilators may save eight to 10 percent on energy costs, by controlling the loss of heated and cooled air.

Repainting a roof from dark to light will help keep the building cool, and prevent excessive build-up of heat in summer.

In crop production, as much as 15 percent in costs may be saved by operating tractors near capacity. Moving large equipment by truck rather than driving it several miles is a measure that can save the farmer eight to 10 percent on energy costs.

Preventive maintenance really pays off; keeping electrical equipment cleaned and properly lubricated may save as much as eight percent on energy costs.

The practice of not plowing quite as deeply

unless there is a plow pan may save the farmer as much as 10 to 20 percent.

Harrowing the fields diagonally when two passes are needed may save two to five percent.

Plowing around fields instead of across them may save two to four percent.

Keeping blades sharp, changing filters regularly, watching machinery adjustments closely and following equipment manuals closely all save energy, as well.

In livestock buildings, energy may be saved by covering windows with plastic, if they are not essential to ventilation.

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For More Information, Call the Arkansas Energy Office: 1-800-482-1122

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RECYCLING

By the Staff of the Arkansas Energy Office

Recycling saves energy. That's a common statement, but how much is saved, really?

Here are figures on some common materials:

Materials	Percentage of Energy Saved by Recycling, per ton
Aluminum	.96
Copper	.87
Iron and Steel	.61
Lead	.63
Zinc	.60
Newsprint	33.3
Tissue papers	27.5
Printing paper	10.2
Packaging board	8.5
Plastics (polyethylene)	.97

Glass has not been given a scientific energy-saving figure so far. One major glass manufacturer estimates that 30 percent of his energy costs could be saved annually if 60 percent of the material entering his furnaces was recycled glass.

Americans pay over $4 billion a year to dispose of these materials, through municipal garbage-collection systems whose fees rise steadily. One study looked at the amount of recyclable materials to be found at the local dump.

The percentages on common wastes were paper, 42 percent; metal, 8 percent; glass, 6 percent; rubber and leather, 0.6 percent; plastics, 0.7 percent; and textiles, 0.6 percent.

Americans now throw out 154 million tons of garbage each year; this is equal to 1,400 pounds per person -- in one year's time.

There is a trend toward recycling, however, and the financial rewards for sorting out glass, metal and paper from other items are rising. Efforts are also being made to erase barriers that slow down recycling movements and favor use of virgin ores.

The community scrap business, found in almost every Arkansas city, has been joined in many places by centers for recycling paper and aluminum. For a list of those centers, call the Energy Hotline: 1-800-482-1122 and ask for your free copy of the Recycler's Directory.

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For More Information, Call the Arkansas Energy Office: 1-800-482-1122

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FIREWOOD

By the Staff of the Arkansas Energy Office

Remember how the rule always was to cut firewood 12 months before you planned to burn it, so it would season properly? Not any

more.

Research compared firewood that dried for 12 months with similar wood that dried for six months, and the moisture content varied just one percent, according to studies performed by the Forestry Sciences Laboratory under the United States Agriculture Department, at Princeton, West Virginia.

The study recommends that firewood to be burned in October should be cut in June. For the best firewood, the wood should be prepared by cutting it to the proper length for burning, splitting it and stacking it off the ground and under cover, with wood ends exposed to the wind.

Drying may be accelerated by stacking the firewood on a black base and using a clear cover.

Wood cut in midsummer could be dried at double the conventional rate by use of solar dryer. The shortest time possible to dry firewood is four months, to obtain the optimum moisture content.

By properly seasoning firewood, wood burners can realize five percent more heat per cord and handle 20 percent less weight than if using freshly-cut wood.

When just cut, Appalachian hardwood used in the federal study contained 30 to 55 percent moisture, and when fully seasoned to the level of 17 percent moisture -- the optimum firewood moisture level -- the drying removes about 1,500 pounds of water per cord.

The species that dry more slowly should be cut first and allowed to season longer. These include hickory, black cherry, beech, and birch. Next in drying speed come white oak, red oak, ash, sugar maple and red maple.

The federal study discovered that moisture dropped sharply in cut wood during the first month, and thereafter, the rate of drying slowed, particularly during winter months. During some months, wood gained moisture, in fact.

Splitting gave an advantage in the drying, the study concluded. White oak that was split ended up with a moisture content two percent less than unsplit wood, for the six-month test period, and with three percent less in the 12-month test period.

The method of stacking did not affect the drying rate.

Using a cover did improve the drying rate in spring-cut white oak firewood.

To accelerate drying, a solar dryer was used. Black-painted particleboard was the base for the wood, and a clear fiberglass roof was placed over the pile. This yielded firewood with up to three percent less moisture than regular covered wood.

To learn more about the dryer design, write Eugene Wengert, Forest Products Extension, Virginia Polytechnic Institute and State University, Blacksburg, Virginia, 24061.

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For More Information, Call the Arkansas Energy Office: 1-800-482-1122

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AUTOMOBILE CONSERVATION

By the Staff of the Arkansas Energy Office

Keep the tires on your car inflated to the maximum marked on the tire itself and you will save gasoline -- and money.

The more pressure you put in your tires, up to the stated maximum, the less gas it takes to drive a mile. That's because harder tires have less resistance to rolling.

Years ago passenger-car tires were mostly one size, and the general recommendation was to keep them inflated to their 32-pound maxi-

mum, in order to make the tires last longer. Then owners' manuals suggested dropping air pressure to 24 or 26 pounds, to get a softer ride.

The high cost of fuel today brings car owners back full circle to the idea of keeping tires inflated to the maximum -- as listed on the tire itself. This may be eight more pounds of pressure than the manual or the sticker on the door of the car recommends.

However, it is useful to maintain whatever difference in pressure between front and back tires the owners' manual recommends. For example, the manual might recommend 24 pounds in the front and 26 in the rear, while the maximum marked on the tire is 32. In this case, you should inflate the front tires to 30 and the rear tires to 32.

All tires slowly lose air pressure. One tire company checked 1,900 cars and found that 28 percent had tires that were severely underinflated. And tests conducted by tire companies and others confirm that more pressure means better gas mileage.

In a report to the federal Department of Transportation, an independent company concluded after examining test results that each two pounds of additional pressure in bias-ply (non-radial) tires improves gas mileage by 1 to 1.5 percent. Because there may be a difference of eight pounds between the owners' manuals and the tire manufacturer's maximum, this presents the possibility of a gas savings of four to six percent.

That is the same as reducing the price of your gasoline.

These savings are possible with highway driving. In town, the percentage will be less because of the time your car spends idling at traffic lights or being braked to a stop.

The saving from increased pressure will be less with radial tires. With radials, eight pounds of increased pressure yields about 2.5 percent in fuel savings.

Radial tires give better gas mileage than non-radials, however, when inflated to the same pressure. At full inflation, you should get about 3.5 percent better mileage in combined city and highway driving.

To realize these savings, you must keep your tires fully inflated all the time. This means checking them about once a week, when the tires are cold and have been sitting for three hours, or before driving them more than one mile.

Get your own tire gauge; they cost only a couple of dollars.

It's true that full inflation will produce a harder ride over bumps, but it does not damage the suspension system, as some believe. It does not shorten tire life, and in some cases, it will increase tire life.

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For More Information, Call the Arkansas Energy Office: 1-800-482-1122

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ELECTRICITY USERS

By the Staff of the Arkansas Energy Office

Do you know what the energy hog in your home is? Compare your appliances and how you use them with this list, which shows the electricity comsumption for one year for various machines:

Large Appliances	Kilowatt Hours Yearly
Room air-conditioners (for 1,000 hours of cooling in an Arkansas summer)	860
Clothes dryer	993
Dishwasher	2,100
Frostfree freezer (16.5 cubic feet)	1,820
Range with self-cleaning oven	730

Refrigerator (12 cubic feet)	728
Frostfree refrigerator (12 cubic feet)	1,217
Refrigerator and freezer, frostfree (17.5 cubic feet)	2,250
Washing machine (including water-heating unit)	103
Water heater	4,811

Small Appliances

Blender	15
Broiler	100
Carving Knife	8
Coffee Maker	140
Deep-fat fryer	83
Egg Cooker	14
Frying Pan	186
Hair Dryer	14
Hot Plate	90
Iron	144
Mixer	13
Microwave Oven	190
Roaster	205
Shaver	1.8
Toaster	39
Trash Compactor	50
Waste Disposer	30

Heating And Cooling

Attic Fan	291
Circulating Fan	43
Rollaway Fan	138
Window Fan	170
Portable Heater	176
Humidifier	163
Dehumidifier	377

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For More Information, Call the Arkansas Energy Office: 1-800-482-1122

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ENVELOPE HOME

By the Staff of the Arkansas Energy Office

A Harrison architect built a home for his family that uses sunlight, cooling breezes, wood heating and the earth itself for the heating and cooling.

"I did it mainly to save energy," said Jeff Laur, the architect. He said that he hoped his monthly utility bills would cost $20, in comparison to a conventional home with bills averaging $100 monthly.

The 2,000-square-foot home appears conventional on the outside, but the unusual features become apparent as a visitor moves inside. This home is fitted inside an "envelope" and actually has one set of walls inside another. Air circulates across the entire house through this open space. Hot air is released out ceiling vents and circulated through the interior by a ceiling fan.

Cooled air is obtained from a system using a storage tank underneath the house, filled with 1,000 gallons of water. The tank is connected to a geothermal well, which draws water from the ground that remains at a constant, cool temperature. The water is constantly recirculated, so that it cools the house, picks up heat, is sent back underground, and is cooled again.

Hot water for the home is provided by a solar collector on the roof and by the wood fireplace. Pipes that hold the logs circulate the water through the fireplace, heating the water in winter.

A solar greenhouse on the south side sends warm air throughout the house, and serves as a main attraction in the home. "I treated it like a family room," Laur said. That supplies usable floor space at the same time the greenhouse helps control heat and cold, he said.

In all, the special features added 10 or 15 percent to the cost of the home, which would run about $72,000 on the market, Laur said.

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A federal tax break on the renewable-resource equipment helped lower the total cost, he added. (This year, a 40-percent-tax-credit is available, and up to $4,000 in credit may be taken on your federal tax return.)

Chuck Ellison, an energy auditor with the Arkansas Energy Office, discussed the project with Laur and offered his expertise in dealing with some questions that arose. Laur also took advantage of experts from Oklahoma, where a major solar industry has arisen.

"It's a question of which way you want to go," Laur said. Other homebuilders might prefer no greenhouse, and earth pipes for cooling, he said, or a passive design might be favored.

Arkansas Power and Light Company installed special monitors to follow the energy efficiency of his home, Laur said.

The well that provides cooling is especially interesting, he said, because that design could serve rural Arkansas home sites that lack access to natural gas. "You can use the system if you can drill a well," Laur said.

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For More Information, Call the Arkansas Energy Office: 1-800-482-1122

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HEAT-PUMP EFFICIENCY

By the Staff of the Arkansas Energy Office

A water well in the back yard may be the next best thing to a gold mine in these days of continually-rising utility bills -- especially if, like Charles King of Pocahontas, this means you could heat and cool your home for $87 a year.

King installed a heat pump system in his 2,500-square-foot home on the advice of Mike Jones, whose Pocahontas firm, Hydro-Temp Corporation, manufactures the heating and cooling units. However, this system represents an advance in comparison to conventional units, and Jones recently received patent number 4,249,390 on his invention.

"I'm quite pleased," said King of his home's central system. The year he spent $87 for heating and cooling, he used a total of only 2,032 kilowatt hours, King said, and in the year just ended in April, he used only 2,400 kilowatt hours -- despite the record heat last summer.

Neighbors in similar homes talk of monthly bills over $100, King said, so his system saves him quite a bit of money. King is a retired teacher.

As a bonus, the exhaust heat from the system is used to heat water, King added, so he does not use electricity for that appliance in summertime. "That's a pretty clever arrangement," King commented.

The key to the system is a link between the compressor and underground water, but little water is actually used in the operation of the compressor, according to Jones. The water-to-air system pulls heat from the home in summer, and introduces heat in the winter, heating water on the side.

The special features that earned him a patent include the fact that the system uses only a third the water of a conventional water-to-air system, Jones said, and that it is able to transfer 100 percent of the waste heat from the home into water heating.

A home built to standards of the Federal Housing Authority would have a two-ton heating and cooling unit normally, Jones said, but with his invention, a one-and-a-quarter ton unit could be used to achieve the same cooling and heating capacity.

Jones estimated that his system cost $1,000 to $1,500 more than a conventional system and he estimated the average payback of that

extra cost would come in only 18 months. He said that had been his experience in working with the electric and propane units in his city.

To install his system, Jones said, he removes the existing unit at a home, drills a water well, and installs his equipment in some closet, inside the heated-and-cooled area.

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For More Information, Call the Arkansas Energy Office: 1-800-482-1122

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HEAT PUMPS

By the Staff of the Arkansas Energy Office

Even a modern, all-electric home can be improved so that utility bills are less, as the experience of a state energy official working with a Little Rock home proves. This 1975 home was equipped with the best insulation of the day, but the electric bills still totaled $1,183 for 1977.

The two-story brick and frame home provided 1,800 square feet of living space that included four bedrooms and two baths. The home was built with attic insulation to a value of R-17, wall insulation to a value of R-11 and an insulated concrete slab for the foundation.

A breakdown in the central air-conditioner in the spring of 1979 led the owner to consider making a change in the system that would use electricity more efficiently, and cut utility bills.

Careful shopping and comparison of one unit with another led to the purchase of a $1,630 heat pump instead of just replacing the compressor on the air-conditioner. The unit was one of the best then sold – with a coefficient of performance (COP) of 2.9. The cooling efficiency or the Energy Efficiency Rating (EER) was eight.

The owner expected to recover his investment in four years at the electricity prices then being charged.

That prediction is proving accurate.

For 1980, the electric bills for the home totaled $1,159, with electricity usage much less that in 1977.

That means an actual dollar savings of $24 when the 1980 bill is compared to the 1977 bill -- and when the owner checked the amount of electricity used in 1977 and figured its price at the 1980 rates, then use of the heat pump saved him $427. Because the electricity was not used, the owner avoided its cost.

This cost-avoidance policy is important to everyone who pays utility bills for a home or a business. The potential for savings and for cutting energy use should attract us all to look into energy conservation practices, to purchase the most energy-efficient appliances, and to upgrade our homes and businesses with extra insulation, storm doors and windows, caulking, and similar measures.

If the homeowner shopped for a heat pump today, even more efficient models would be available. Conservation is worth money, and comparison shopping is one way to make a heat-pump or air-conditioner investment even more valuable.

For example, one national firm sells several grades of air-conditioners. The model that provides 34,200 British thermal units an hour (Btuh) would cool the homeowner's residence. The cheap model of that size has an EER of 6.65, and this unit would cost the homeowner $180 for its operation during an Arkansas cooling season, at current electric rates.

The best model of the line, however, has an EER of 9.3, and would cost the homeowner only $136 for an Arkansas cooling season.

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(Ron Stanfield lectures on home energy conservation for the Arkansas Energy Office.)

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ELECTRIC BLANKETS

By the Staff of the Arkansas Energy Office

One way to beat the rising cost of energy is to turn down the thermostat in your home and keep warm at night under an electric blanket.

Savings of up to 29 per cent in home energy consumption were the result of an experiment performed by Eastern Illinois University at Charleston, under a grant from an electric blanket manufacturer.

The number of people or beds in a household makes little difference in the potential savings, according to the study, and the size of the home does not affect the potential savings, either.

In the experiment, homeowners were asked to use the electric blankets and turn down their thermostats at least 10 degrees for their eight-hour rest period.

All-electric homes, propane heating and natural gas heating were tested in the experiment and similar savings resulted in all types of heating systems.

About one kilowatt hour of electricity is used in eight hours to heat an electric blanket. In Arkansas, where five cents is the cost of a kilowatt hour, that is the cost of a night's warmth under an electric blanket.

Another cost-cutting measure would be to use standard window shades to slow the passage of heat and cold through windows. Average savings of $168 could be realized in fuel and utility costs, according to a study performed at North Carolina State University at Raleigh and financed by the Window Shade Manufacturers Association.

The light-colored opaque shade that is the most common proved to be effective in controlling heat transfer, although draperies and venetian blinds also were tested.

A typical house has 200 square feet of windows and without shades, $166 in cooling is wasted -- when the addition of shades could save $100 in summer.

Heat that escapes through windows in winter averages $196 for the season, and shades could save $68 in this season.

About $135 would be required to put shades on the typical home, and in many parts of the nation, that investment would be recovered in the first year. Shades should last five to 10 years, so they would continue to serve as a cost-cutting measure many years after their cost was repaid.

In summer, a well-fitted shade with a minimum space between its vertical edges and the window frame will deflect the sun's rays so that the house does not heat up so quickly.

In winter, a shade that hangs close to the glass will cut down on the movement of air and form a barrier of still, insulating air between the shade and the window, at night. By day, the shades should be raised, to take advantage of the warmth of winter sunlight in the home.

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For More Information, Call the Arkansas Energy Office: 1-800-482-1122

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CONSERVING NATURAL GAS

By the Staff of the Arkansas Energy Office

Gas heating systems, upon which most Arkansas homes depend, are rapidly changing as possible reductions in gas supplies and the rising costs of natural gas make themselves felt in the home heating industry.

A closer look has been taken by major manufacturers of home heating systems at the sizing of their units, their gas consumption, and their design, overall.

Both existing manufacturers as well as new companies entering the field are designing units with an increased efficiency. These units range from approximately 65 percent combustion efficiency to some that have an efficiency rating of 85 percent, or more. Some gas is lost through venting in any system, and so the goal of the industry is to hold as much fuel as possible in a system and extract as much energy as possible from the natural gas.

In addition to this innovation, some manufacturers are also offering units that are smaller in capacity, to meet the actual heating requirements of today's smaller home, which is also much better insulated than those built years ago.

A correctly-sized unit will reduce the consumption of fuel, and, as a bonus, those cold spots that occur when too large a unit continually cycles on and off are eliminated.

Proper design will also reduce the loss of heat out the vent, and that might permit more ease in locating the central system, because high-temperature vent pipes would no longer be a problem.

Gases now vented from some units range from 150 to 200 degrees Fahrenheit; that creates quite a hot spot if placed incorrectly in a home.

When you shop for a new heating system, ask about the improved efficiency of new units and see that your home is not only well heated, but efficiently heated.

It is possible that your new heating system might be an Arkansas invention; five Mountain Home men formed Arkansas Patents, Inc., and one of their first devices was a home heating system. This system is a modification of an 80,000 Btu gas heating unit; the inventors named it Heat Amplified by Energy Radiation, or HASER.

A patent is pending on the invention, according to Ralph Wooldridge, president of the enterprise. He said that conversations were being held with possible manufacturers and distributors of the device. The Mountain Home inventors do not wish to take on that task, he said.

The virtue of the HASER, Wooldridge said, is that less gas is required for heating a building, and the gases vented from the system are cooler than those vented from conventional systems.

"Your energy is going up the flue," Wooldridge said of existing systems.

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For More Information, Call the Arkansas Energy Office: 1-800-482-1122

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SOLAR HOUSE PLANS

By the Staff of the Arkansas Energy Office

As you plan that new home you are building, get back to the basics; take advantage of those building techniques that have warmed and cooled American homes for centuries.

With utility bills going up every month, that could be one way to keep costs under control.

Solar Homes for the Valley, published by the Tennessee Valley Authority, offers 11 home designs that use various methods of heating and cooling; one might suit your family – and your pocketbook.

Each design offers features such as windows oriented to the sun's rays; an air-circulation system that allows for heat rising and moving across cooler air, and massive elements that

absorb heat from the sun and release it at night into the house.

Overhangs provide shade in hot summer months to lessen the amount of sunlight coming into these homes and natural ventilation provides pathways for cooling breezes through the rooms.

Each house is extremely well insulated, with ceilings insulated to the value of R-30, and walls insulated to a value of R-19.

Back-up heating and cooling is arranged with heat pumps, and wood stoves and fireplaces are included in some designs.

Planting notes are included to help in seeing that shrubs and trees are located in the best places to help control extremes of heat and cold.

These are the design descriptions:

Home One - provides 1,210 square feet on a single level; two or three bedrooms may be installed. South windows collect heat from the sun and a Trombe wall provides mass that collects heat and releases it at night. A wood stove would be placed between the living room and kitchen.

Home Two - provides a two-story home with 1,008 square feet on each level; part of that may be left unfinished for expansion later. This must be built on a south-facing slope. The home fits into the hillside, which helps to temper heat and cold, and a sunporch takes advantage of sun on the south exposure.

Home Three - provides 2,116 square feet on two levels. An atrium that stretches up to two stories admits light into the living and dining areas, and large water storage tubes on one side store up heat by day and release it at night.

Home Four - offers the traditional saltbox with 1,578 square feet. Heating comes from water drums behind the window glass. Space for a greenhouse or porch is also arranged.

Home Five - offers a contemporary design for a two-level home with 1,872 square feet. A south greenhouse is also the entryway. The back greenhouse wall is heavy masonry to retain heat.

Home Six - saves money by allowing the framing to be of rough-sawn lumber, and provides 1,406 square feet. Water drums collect heat on the upper level and ducts carry the cooled air beneath the house to maintain air circulation.

House Seven - uses a water wall on the south side for controlling temperature in the contemporary split-level home of 1,824 square feet. An attached garage brings the total size to 2,324 square feet.

Home Eight - offers the smallest design, with 1,003 square feet. A Trombe wall on the east side holds in heat and a wood stove heats the living room.

Home Nine - is a two-story farmhouse with 1,406 square feet and a living-room fireplace. A Trombe wall is used to control the temperature.

Home 10 - fits into a hillside and controls the heat with the earth. Skylights and a Trombe wall are also featured in the home, which has 1,664 square feet.

Home 11 - is a small gable home with 1,210 square feet that could be used repeatedly in a housing development plan. Skylights in a cathedral ceiling admit sunlight to heat an interior masonry wall, and summer vents keep the home cool. A wood stove divides the living room and dining room.

To get your free copy of this house plan book, write Herb Stonebrook, Tennessee Valley Authority, Box 470, Tupelo, Mississippi, 38801 and ask for *Solar Homes For The Valley*.

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For More Information, Call the Arkansas Energy Office: 1-800-482-1122

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TURBINE VENTS

By the Staff of the Arkansas Energy Office

With the coming of winter, many people are considering closing the turbine vents on the roof of their home, while others maintain the turbine vents should be left open. Which is best?

The answer depends on features to be found in your attic.

First of all, an attic should be ventilated in winter -- to prevent an accumulation of moisture. Moisture could cause damage to both insulation and the structural parts of the house.

The recommended amount of ventilation depends upon the arrangement of the vents in the attic, and whether or not a vapor barrier has been installed. A vapor barrier would be a sheet of plastic or foil placed under the insulation.

If there is no vapor barrier and if the attic vents are all located at the same height, whether high or low, then one square foot of net free area is recommended for each 150 square feet of attic space. Net free area is the area of the vent that allows air to pass, taking into account and subtracting the structural parts of the vent that would bar air.

If there is a vapor barrier, or if the attic has vents at high or low position, with some at least three feet above others, then one square foot of net free area is recommended for each 300 square feet of attic area.

If the turbine vents are in excess of these basic requirements, and provide more ventilation than described here, then they may be closed off without probable damage and perhaps a little savings in winter heating costs.

If the turbine vents are required to provide the minimum ventilation, then they should not be closed.

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For More Information, Call the Arkansas Energy Office: 1-800-482-1122

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AIR-CONDITIONERS

By the Staff of the Arkansas Energy Office

An extra effort in shopping will pay off in years of reduced electric bills when you select a new air-conditioner for your home or apartment. Getting an efficient unit will mean less electricity is used to cool your home, and the proper size will also demand less power than oversized units.

Figure for yourself the size you would need for your room, using the formula "WHILE - divided-by-60."

A typical room 9 x 12 feet would require a 4,000-Btu (British thermal unit) air-conditioner. Measure your own room to be cooled and check on the insulation it has, as well as the exposure to sunlight.

Multiply these figures:
W is the width in feet
H is the height
I is the insulation -- use 10 for well-insulated and 18 for poorly-insulated space
L is the length
E is exposure to sunlight on the longest outside wall face -- use 16 for North; 17 for East; 18 for South; and 20 for West.

Example: a room 15 x 8 x 20 feet, well-insulated, with a long wall facing south, would be calculated this way: 15 x 8 x 10 x 20 x 18 equals 432,000 divided by 60 equals 7,200. This room needs an air-conditioner with a

capacity of just over 7,000 Btu.

Restrain the impulse to buy a unit with lots of additional cooling capacity. A bigger unit will consume electricity in bigger gulps, despite the fact it will not run as frequently. The longer running time of the properly-sized unit has another bonus -- that continued operation removes moisture from the air on a steady basis, and that feature would be lost with an oversized unit.

The next step in selecting an air-conditioner is to search for efficiency. The quick method is to look for the Energy Efficiency Ratio (EER) tag on the models you inspect. The higher the EER, the more efficient the unit, and the less it will cost to operate.

For example, a 7,200-Btu unit on display in a store with an EER tag of 6.2 would cost the Arkansas homeowner $83.59 for operation during an average cooling season of 1,200 hours. The unit with an EER rating of 9.4 however, would cost only $55.15.

If the plan is to install a central air-conditioning unit, be sure to have a professional calculate the heat load of the house. If insulation or storm windows have been added, a smaller unit should be necessary, and that would save you money.

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For More Information, Call the Arkansas Energy Office: 1-800-482-1122

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INDOOR POLLUTION

By the Staff of the Arkansas Energy Office

Is indoor air pollution a threat if your home is tightly sealed against air leaks to conserve energy used in the heating and cooling system? Not according to a recent scientific study of such houses.

Major pollutants -- nitrogen dioxide, formaldehyde, and radon -- all were found to be within suggested guidelines, and all were found in small amounts that constituted no harm to those living in the test homes.

The study, performed with federal funds by staff of the Lawrence Berkeley Laboratory at Berkeley, California, measured the air leaks and pollution levels in four energy-efficient homes constructed at Eugene, Oregon. The homes were built according to the same specifications pioneered by the Arkansas Power and Light Company.

AP&L and other utilities are encouraging energy conservation as one way to control ever-rising utility bills, and one way to do that is to use less for space heating and cooling. The utility recommends that new homes be heavily insulated and sealed against air leaks.

The AP&L standards call for insulation values of R-38 in the ceiling, R-19 in walls and floors, R-4 for an unheated slab floor, or R-6 for a heated slab floor, and R-7 around ducts. A vapor barrier is recommended as a ground cover beneath crawl space floors and caulking is suggested around windows and wall joints. Storm windows and doors are recommended.

In the homes tested for pollution, there were 0.34 air changes per hour during the average heating season. By contrast, typical Arkansas homes built to older standards would have two to three air changes an hour. This refers to the air leaking in and out of a house, expressed in terms of the entire volume of air in the home being replaced, or exchanged, by fresh air from leaks, over the period of one hour.

Concern that this reduced ventilation might lead to health problems inspired this study. Tested were the chemicals from tobacco smoking, cooking and heating (nitrogen dioxide), as well as chemicals released into the air by cleaning products and other materials used by the occupants. The chemicals given off by furniture fabrics and building materials (formaldehyde) also were checked.

Nitrogen dioxide was at a low level, although a bit more of the chemical was found in two houses where occupants smoked in comparison with the two homes without smokers.

Formaldehyde was at or below the most restrictive existing guidelines.

Radon, or radioactivity, was insignificant.

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For More Information, Call the Arkansas Energy Office: 1-800-482-1122

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APPLIANCE ENERGY CONSERVATION

Tips on saving energy while you operate your washer or dishwasher, provided by the Association of Home Appliance Manufacturers, are reprinted below. To learn more, write the Association at 20 North Wacker Drive, Chicago, Illinois, 60606.

SAVING ENERGY
-- AND MONEY --
WITH YOUR REFRIGERATOR-FREEZER

Through a wise, careful purchase . . .

Generally, larger refrigerator-freezers (especially larger freezer sections), colder freezer temperature, and automatic defrost systems will use more energy.

Refrigerator-freezer energy use depends mainly on three factors:

* the overall size,

* the freezer size and temperature, and

* the type of defrost system.

These three factors are directly related to the **door style.**

The Single Door Refrigerator
(Includes compact models)

Overall Size: The total volume ranges from 1.7 to 14.0 cubic feet.

Freezer Size and Temperature: Freezing section volume ranges from .36 to 2.09 cubic feet. Freezer temperature is about 15°F, for ice cubes and short-term food storage.

Defrost System: Almost all single door refrigerators have **manual** defrost. A few larger sizes have partial or automatic defrost.

The Two-Door Combination
Refrigerator-Freezer

Overall Size: The total volume ranges from 7.7 to 22.9 cubic feet.

Freezer Size and Temperature: Freezer volume ranges from 1.49 to 7.65 cubic feet. Freezer temperature is **zero zone** (about 5°F or below) for long-term food storage.

Defrost System: With the exception of a few smaller models, all two-door combination refrigerator-freezers have either **partial automatic** or **automatic** defrost systems.

The Side-By-Side
or
Three-Door Combination
Refrigerator-Freezer

Overall Size: The total volume ranges from 18.3 to 27.8 cubic feet.

Freezer Size and Temperature: Freezer volume ranges from 6.31 to 10.26 cubic feet. Freezer temperature is **zero zone** (about 0°F or below) for long-term food storage.

Defrost System: All side-by-side and three-door models have **automatic** defrost systems.

Freezers

Overall Size: Chest freezers range from 5.1 to 28.0 cubic feet, upright models from 5.2 to 31.1 cubic feet.

Freezer Temperature: All freezers have **zero zone** for long-term food storage.

Defrost Systems: All chest freezers have **manual** defrost. A few upright models have **automatic** defrost systems.

Note: All capacity ranges are based on ratings listed in AHAM's January, 1979 Directory of Certified Refrigerators and Freezers.

A Word About Defrost Systems . . .

The three types of defrost systems are:

Manual -- You have to turn the refrigerator control to "off" or "defrost" so the cooling surfaces will warm up and the ice loosen from the surfaces. The defrosted water and ice from both the refrigerator and freezer sections must then be removed by hand and the refrigerator restarted by setting the temperature control to the right setting.

Partial Automatic (Cycle Defrost) -- The cooling surface in the fresh food (refrigerator) section will defrost automatically each time the unit stops running. Normal refrigeration is not interrupted. The freezer section, however, must be defrosted manually.

Automatic Defrost -- Frost is removed automatically in both the refrigerator and freezer sections.

Generally, automatic defrost systems consume more energy. However, you can make up for some of this added energy use in several ways: you won't have frost building up on the surface which, if more than a quarter-inch thick, makes your refrigerator-freezer run longer and work harder; you won't have to use outside heat to defrost and then have to use extra energy to lower the temperature again; and, because there is no frost build up, you will have more space to store frozen food and cut down on shopping trips to the store.

How Big?

Choose the right size refrigerator-freezer for your needs. A "too large" model refrigerates more space than your family needs. A "too small" model will require extra trips to the store or filling the unit too full for adequate air circulation.

If you live alone, seldom eat at home and about the only time you open your refrigerator is for ice cubes or a quick snack, the smaller, single-door refrigerator may be the right choice for you.

On the other hand, if you answer "yes" to most of the following questions, you probably should consider a larger refrigerator-freezer.

Do you have a large family?

Do you live quite a distance from the grocery stores?

Do you usually buy some foods in large quantities?

Do you have a garden or live near seasonal fresh food suppliers and buy such foods in quantity for freezing?

Do you prepare meals for several days in advance and freeze them?

Do you have leftovers often?

Do you entertain often?

The largest combination refrigerator-freezers currently available provide 17 cubic feet of fresh food compartment space and 10 cubic feet of freezer space. If your family needs more space than this, you should consider a separate freezer.

Operating Cost

The operating cost will vary from model to model. Once you decide on the size and type of refrigerator-freezer you need and any special features you want, try to choose one with a lower operating cost that has all these characteristics. The price tag may be somewhat higher but lower utility bills can eventually pay back the extra money spent.

Look for the yellow energy label that appears on each refrigerator-freezer model in the store. This label will tell you the **estimated** yearly operating cost of the model. This cost is based on (1) how that model performed under laboratory tests and (2) an average national utility rate. Other information on the label will help you figure out more closely what it will cost **you** to operate this particular model based on **your** local utility rate.

Always Follow The Manufacturer's Instructions In The Use And Care Booklet Provided With Your Refrigerator-Freezer.

Use your refrigerator-freezer. Once plugged in, it works day and night. If you let it sit empty and don't use it to advantage, you waste energy. With a little imagination and planning, you can make up for some of your refrigerator-freezer's energy use. In other words, your refrigerator-freezer can "pay you back" and save energy too. For example,

* Prepare several meals at one time and freeze them for later use. This will save energy by making the most use of your cooking heat and eliminate heating up the oven at different times. It also provides convenient, speedy meals for surprise guests or especially busy days.

* Consider buying a larger capacity refrigerator-freezer. This will enable you to buy foods at bargain prices and freeze them for later use. You can also buy foods in larger quantities and cut down on the number of shopping trips. Unnecessary trips waste both valuable time and fuel if you drive to the store.

* Preparing food -- whether you bake,cook, broil, fry or roast it -- uses energy. That's why throwing away good food is another way to waste energy. If you have a larger freezer space, you can freeze leftovers and eliminate unnecessary food waste.

If your model has an anti-sweat heat switch (sometimes referred to by the manufacturer as a "power-saver", "power economizer" or some other such term), use it according to the manufacturer's instructions. Generally, the heater should be turned "off" when the weather is dry and "on" when the weather is humid.

Place your refrigerator-freezer in a level, dry, cool, well-ventilated location. Make certain there is enough space behind and above the unit to allow enough air circulation to the condenser, if it is on the back.

Set your refrigerator and freezer temperature controls to the medium range as indicated on the dials or in your use and care book. After several days' use, you may have to move the dials to colder or warmer as necessary. Do avoid unnecessary colder settings that waste energy.

Check the door seals occasionally. Be sure they're clean and sealed properly. Check the seal at various positions on both sides, top and bottom of the door. Also check for tears, holes and gaps. A deteriorated seal should be replaced immediately.

Instruct all family members -- especially the children -- to always check to make sure the door is completely closed after being opened.

Defrost manual or partial automatic models regularly. Don't let more than a quarter-inch of frost build up. Frost acts as an insulator, making the refrigerator use more energy to maintain temperature levels.

Keep the refrigerator (fresh food) section to almost full capacity but keep enough space between food items so the air can circulate freely. Be careful not to block the air vents.

Keep the freezer section full to near capacity to help keep the cold in when the door is opened.

Instruct all family members to open the refrigerator door as few times as possible. Most of the food needed for one meal can be removed or replaced at one time. Keep an accurate up-to-date list of the food in your freezer and where it is located so you can find particular items quickly.

When loading the freezer, limit the amount of unfrozen food put in at one time. Only the amount of unfrozen food that will freeze within 24 hours should be put into the freezer. Usually that will be about 2-3 pounds per each cubic foot of freezer capacity, according to the USDA.

Clean your refrigerator condenser coils at least twice a year with the crevice nozzle attachment of your vacuum cleaner or a long-handled brush. Be sure to turn the refrigerator-freezer off first. Check your use and care booklet for condenser location and cleaning instructions.

If you keep your old refrigerator as extra, backup storage, plug it in only when actually in use. Block doors open so odors and mold will not develop. (As a special note, remember to make your empty refrigerator safe for children. Either chain the door shut, block it open or take off the door.)

During long vacations, empty your refrigerator-freezer of foods that will spoil and set the temperature dials slightly warmer or, if possible, empty all the food from the refrigerator-freezer, unplug it and leave the door open. (Again, remember to make the unit safe for children.)

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SAVING ENERGY -- AND MONEY -- WITH YOUR RANGE

Through A Wise, Careful Purchase . . .

Whether you choose a gas or electric range depends on your personal preference and on what fuel hookup you already have in your house. Once you decide, range brands and models within the same fuel category will vary little in every use.

If you decide on a gas range, choose one with an **electric ignition.** It eliminates the oven and surface burner pilot lights. Constantly burning pilot lights use extra energy. Almost all models have electric ignition.

These three types of ovens can also save energy.

A Self-Cleaning Oven. This oven uses less energy than a standard oven because of the extra insulation needed for the very high temperatures reached in the cleaning cycle. If you use the cleaning cycle sensibly (less than once a month) by avoiding unnecessary spillovers, you can save energy with this oven.

A Convection Oven. A blower forces heat into the oven directly to the food and recirculates the air through the system. Only about 10 percent of the heat is exhausted through the oven vent. In some models, no preheating is necessary. Cooking temperatures can be lowered by about 25 percent and cooking times can be shorter. Gas range models can provide energy savings of up to 40 percent.

A Microwave Oven. This oven can help you save energy depending on the type and amount of food cooked, your cooking habits and how often you use it. AHAM tests found that homes using a standard range and a microwave oven used about 14 percent less energy to cook than those with only a standard range.

Always Follow The Manufacturer's Instructions In The Use And Care Booklet Provided With Your Range.

Don't use your range to heat the kitchen.

Follow package and recipe instructions, especially for time and temperature settings. Make sure you turn off **all** controls after using your range.

Use the refrigerator or microwave oven when you thaw frozen food before cooking.

THE OVEN

Make **full** use of the heated oven. Plan ahead with complete oven or broiler meals.

Use leftover heat to warm plates or heat rolls after the oven is turned off.

Don't be an "oven peeker." A significant amount of heat escapes each time you open the oven door. Food takes longer to bake and

the loss of heat can affect browning and baking results. Depend, instead, on thermostats, timers and the oven door window.

Double your recipes and freeze half for later use.

Make sure the oven door closes tightly. Keep the seal clean and check it regularly for tears or cracks.

Use the cleaning cycle on the self-cleaning oven right after baking or roasting. The oven won't have to heat up that much more to get to the cleaning temperature. When basting, checking temperature or adding vegetables, remove the roast pan from the oven and close the door.

Arrange racks to accommodate baking pans **before** turning on the oven.

Keep preheating to the shortest possible time. Sometimes preheating is unnecessary.

Check your use and care manual to see if the manufacturer recommends use of foil in your oven. Using aluminum foil as an oven liner might reduce oven efficiency in some models.

THE SURFACE UNITS

Fit the pot or pan to the size of the surface unit. A six-inch pan on an eight-inch unit wastes energy.

Use pots and pans with flat bottoms. This is especially important with ceramic and smooth top ranges.

Use pots and pans with straight sides and tight-fitting lids.

Place the pan on the surface unit **before** turning it on.

Start most foods on a high heat setting and reduce to a lower heat as soon as foods reach boiling. On electric ranges the unit can be turned off minutes ahead of time and the leftover heat will continue to cook the food.

Cook with as little liquid as possible. Vegetables, especially, will be more nutritious and look and taste better.

Cook foods at the lowest possible setting.

Do not overcook. (Most people do!)

Use the thermostatically controlled surface units or burners, if you have them. These units have a heat sensing element in the center which cycles on and off to maintain a certain temperature. Check the manufacturer's instructions on their use.

Keep reflector drip pans under the surface units clean.

THE GAS RANGE

Make sure pilot lights are adjusted properly.

Check the gas flame. It should be pure blue. If the flame is yellow, it needs adjusting by a qualified technician.

Remember . . . You Save Money When You Save Energy Because You Lower Your Gas and Electric Bills!

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SAVING ENERGY -- AND MONEY -- WITH YOUR AUTOMATIC CLOTHES WASHER

Through A Wise, Careful Purchase . . .

Look for these **energy-saving features:**

* Controls to select various water levels so you can match the amount of water to the size of the wash load.

* Controls to select water temperature. Warm and cold options are important.

* Suds Saver. With this feature you can re-use wash water for additional loads.

Compare models for **water usage.** You'll find this information in such manufacturer literature as specification sheets and hang tags.

Consider a clothes washer with a **lower operating cost.** The price tag may be somewhat higher but lower utility bills will eventually pay back the extra money spent. A yellow "ENERGYGUIDE" appears on each washer model displayed in the store. This label will tell you the **estimated yearly** operating cost of the model. This cost is based on:

* how that model performed under the laboratory testing, and

* an average, national utility rate.

The "ENERGYGUIDE" will also give information to help you figure out more closely what it will cost **you** to operate this particular model, based on the number of loads **you** wash a year and **your** local utility rate.

Always Follow The Manufacturer's Instructions In the Use and Care Booklet Provided With Your Washer.

About 90 percent of the energy used for washing clothes automatically is for heating water. So the most important way to save energy and money is to

USE LESS HOT WATER

Use a **cold** water rinse. The temperature of the rinse water does not affect cleaning.

Use hot water only for heavily soiled loads and for sanitation purposes. Most laundry loads can be washed in warm water. Some lightly soiled loads can even be washed in cold water.

Match the water level to the size of the load. Don't use more water than necessary. Use low water settings for small loads.

Use your washer only during off-peak utility hours. Check your local utility for these hours. They are usually in the early morning and late evening. (Note: Unless the utility offers special rates, this will not save energy or money. It will contribute, however, to the nation's conservation efforts.)

If you are not satisfied with your wash load, you'll probably wash that load again. This wastes energy, money and your time! It also causes needless wear on your clothes. To get satisfactory results:

* Sort articles carefully by color, amount of soil, type of fabric. Separate lint "givers" (towels, chenille) from the lint "takers" (corduroy, permanent press, synthetic knits).

* Pretreat stains and heavily soiled areas **before** washing.

* Use the right amount of detergent. **Always** check the use and care booklet and the directions on the detergent box or label for the right amount of use with a particular wash load. (You'll probably need to use more detergent for hard or cold water, larger loads and heavily soiled loads.)

* Use your washer to full capacity but **don't overload** it. Load items loosely enough in the tub to allow good movement for washing and rinsing.

* Use the correct cycle for the particular wash load.

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SAVING ENERGY -- AND MONEY -- WITH YOUR AUTOMATIC CLOTHES DRYER

Through a Wise, Careful Purchase . . .

The most important way to save energy and money with your clothes dryer is to

SHORTEN THE DRYING TIME WHENEVER POSSIBLE

Dryer running time is controlled in three basic ways --

Time Setting. The user sets the drying time for a specific number of minutes.

Thermostatic Sensing. A thermostat senses temperature increases in the air exhausting from the dryer. Since moisture tends to cool this exhaust air, as the moisture decreases the exhaust air temperature increases. At a given temperature the thermostat causes the dryer to cycle to a cool down period and shut off.

Moisture Sensing. The dryer has electronic sensors which respond to electricity conducted by moisture in clothes. As moisture decreases, less electricity is conducted to the sensors.

Saving energy with any of these three dryer types depends on

WHETHER YOU KNOW WHAT A PROPER LOAD IS

Do not mix heavy and light articles or synthetics and permanent press with cottons in the same load. If you do the dryer will run longer than necessary and waste energy.

Always Follow The Manufacturer's Instructions In The Use and Care Booklet Provided With Your New Dryer.

Don't overdry. You are probably overdrying some of your clothes. This not only wastes energy but shortens fabric life, causes shrinkage and generates static. Try to reduce your regular drying time by **about five minutes** or more. Remember . . . most fabrics have some natural moisture and should not be "bone dry." Seams and waistbands should still have a hint of moisture when taken out of the dryer.

Don't overload the dryer. Articles must be able to tumble freely.

Remove as much water as possible from washed articles before putting them in the dryer. Spinning in the washer usually removes water sufficiently.

Dry only full loads. Don't use your dryer for just a few articles.

Clean the lint trap screen **after** each load and check it **before** each load. If too much lint is on the screen, the air will not move freely and the dryer will run longer.

Use the automatic cycle if your dryer has one.

Be sure your dryer is exhausted properly to the outside. Use the straightest, shortest duct for venting. Keep the outside vent clean. Check it at least monthly. Also check the flapper on the outside hood to make sure it opens and closes freely. A flapper that remains open allows heated air to escape and cold drafts to enter the house.

If possible, dry loads one right after another. In this way you can use the heat left over from the previous load.

Do not install your dryer in an unheated room.

Don't add wet items to a partially dried load.

Don't open the dryer door unnecessarily.

Remove articles to be ironed while still damp. Some fabrics such as corduroy, quilted items and knits keep shape better if not dried completely.

Remove items as soon as the dryer stops. This prevents wrinkling and can cut down on ironing and avoid restarting the dryer to fluff out wrinkles.

Try to use your dryer only during off-peak **utility** hours. Check your local utility com-

pany for these hours. They are usually in the early morning or late evening. (Note: This does not save money or energy unless the utility offers a special reduced rate. It is, however, a patriotic conservation technique.)

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SAVING ENERGY -- AND MONEY -- WITH YOUR DISHWASHER

Through A Wise, Careful Purchase . . .

Look for these energy-saving features:

* Short cycle selections. These shorter cycles use less hot water and are used for lightly soiled dishes. Using these cycles can save up to 25 percent of water heating energy costs.

* Less hot water usage. Models vary as to the number of gallons of hot water used in a cycle. Check the company's specification sheets, buying guides and other product literature for this information.

* An "air dry" selector. This feature automatically shuts off the heat during the dry cycle. This can save up to 30 percent of the electricity used by the dishwasher. You'll find it on most newer models.

Look for the **yellow energy label** that appears on each dishwasher model in the store. This label will tell you the **estimated** yearly operating cost of the model. This cost is based on (1) how that model performed under laboratory tests and (2) an average national utility rate. The label will also give information to help you figure out more closely what it will cost **you** to operate this particular model, based on the number of dishloads **you** wash a year and **your** local utility rate. Try to choose a dishwasher with a lower operating cost. The price tag may be somewhat higher but lower utility bills will eventually pay back the extra money spent.

Always Follow The Manufacturer's Instructions In The Use and Care Booklet Provided With Your Dishwasher.

Four to six times as much energy is used to heat the water that goes into the dishwasher than to operate the dishwasher mechanically. So the best way to save energy with your dishwasher is to

USE LESS HOT WATER

Don't stop using your dishwasher. You will probably use **less** energy using your dishwasher than if you do dishes by hand. Most people think a dishwasher fills completely with water. Actually, about 2 to 3 gallons of hot water are used for each "fill." This fills the machine tub below the bottom rack. What cleans your dishes is not the amount of water but the force and direction of the water and the detergent action.

Wash only **full** loads. Running two half loads will take twice as much energy as a full load.

If you wash dishes at least once a day, don't waste water pre-rinsing dishes. Newer models require only that dishes be scraped off and liquids emptied. If you do pre-rinse, use cold water.

Don't use the drying cycle. Instead, use the "no-heat" selector or turn off the dishwasher after the last rinse. Normal air convection will dry the dishes. While this does take longer (overnight for best results), the savings are significant.

Use the special cycles on your dishwasher. Always use the shortest cycle that will satisfactorily wash the load.

Keep your dishwasher away from your refrigerator-freezer. Dishwashers produce moisture and heat which will make your refrigerator-freezer use more energy. If you must install your dishwasher close to the refrigerator-freezer, install a layer of fiber glass insulation in the enclosure between the two appliances.

Try to run your dishwasher during off-peak utility hours. Check your local utility for these hours. They are usually in the early morning or late evening.

If your dishwasher has a filter, check it often to be sure it is not clogged with food particles. Some filters are self-cleaning.

If you wash a load of dishes but aren't satisfied with the result, you'll likely run the load again. This wastes energy. To get satisfactory results:

* Load the dishwasher according to the manufacturer's instructions. Every model loads a little differently. Some models have a diagram inside the door to show you how.

* Make sure the water coming into the dishwasher is not lower than 140°F. Use a cooking thermometer to check this. Run the water in the faucet closest to your dishwasher (probably the kitchen sink) for several minutes. Then hold a cooking thermometer under the water stream to check the temperature.

* Use only automatic dishwasher detergent. Check your use and care booklet for the amount to use. You may have to experiment a little.

* Don't store dishwasher detergent for long periods of time. It will cake and become stale and won't perform satisfactorily. It should be kept in a dry place -- not under the sink. Glass jars or tight canisters are good for storage.

* If your dishwasher has a rinse agent dispenser, keep it filled. It will help you get more spot-free drying. Rinse agents are available in liquid and solid form in the supermarket.

Remember . . . You Save Money When You Save Energy Because You Lower Your Gas And Electric Bills!

†

SAVING ENERGY -- AND MONEY -- WITH YOUR ROOM AIR CONDITIONER

Through A Wise, Careful Purchase . . .

When choosing a new room air conditioner, you should consider these two important factors:

1. The cooling capacity

2. The operating efficiency

Cooling Capacity

A room air conditioner's cooling capacity is the amount of heat and moisture transferred from indoor air to the outdoors. This capacity is expressed in British thermal units per hour (BTU/hr). A BTU is the amount of heat required to raise the temperature of one pound of water 1°F or about as much heat as given off by a wooden kitchen match burning to ashes.

A unit with a cooling capacity of 6,000 BTU/hr would, for example, be able to transfer 6,000 BTU's heat every hour. The **higher** the BTU/hr, the **greater** the cooling capacity.

Through an AHAM certification program, cooling capacity is rated and certified by the manufacturer using standard laboratory test procedures and then verified by an independent laboratory. The certified capacity ratings are then listed by brand and model number in an AHAM directory. These directories can be obtained from your dealer or AHAM. Room air conditioners whose capacity is **certified accurate** will have a special AHAM seal. When choosing the capacity of your new room air conditioner,

BIGGER BTU CAPACITY
IS NOT NECESSARILY BETTER

A room air conditioner with too much cooling capacity will result in a cold, clammy feeling in the room because it will not run long enough to lower the humidity. A unit that's too small will not be able to cool the room adequately.

DON'T GUESS CAPACITY

To help you figure out what capacity you need, get a **Cooling Load Estimate Form** from your dealer or AHAM. This form will show you how to figure out the capacity you need using such factors as wall, ceiling and floor area and materials; number of windows; amount of shade; number of occupants; the number of heat producing electrical products in the room; and your geographical location. The result of your calculation will be in BTU/hr. Be sure to buy a unit closest to that capacity, within ± 5 percent if possible.

Operating Efficiency (EER)

Once you have determined what capacity room air-conditioner you need, look for a high efficiency model in that size. A high efficiency room air-conditioner uses less electricity so it costs less to operate.

Room air-conditioner efficiency is measured by **EER (Energy Efficiency Ratio)**. EER is computed by dividing BTU/hr by the watts of power used (BTU/hr per watt).

You'll find a yellow label on the room air conditioners displayed in the store. This label will give the EER for that particular model. It is important to remember

THE HIGHER THE EER,
THE MORE EFFICIENT
THE ROOM AIR-CONDITIONER

For example, let's compare two units of the same cooling capacity. One has an EER of 8.8, the other 6.3. The 8.8 EER unit is the more efficient room air conditioner.

Always Follow The Manufacturer's Instructions In The Use And Care Booklet Provided With Your Room Air Conditioner.

Reduce the outside heat coming into your house.

* Cover the windows against sunlight with drapes, shades, shutters, awnings or overhangs.

* Use storm windows. The best kind can be opened and closed as the weather changes.

* Weatherstrip doors and windows and keep tightly closed.

* Close all unnecessary openings such as fireplace dampers, when appropriate.

* Add insulation, but first get professional advice. Even if the house is already insulated, additional ceiling insulation will help if the original is rather thin. As a general rule, ceiling insulation should be 6 inches thick, wall insulation 3 to 4 inches thick.

* Use an exhaust fan in the attic. One with a thermostatic control will assure that the fan does not use energy except when needed.

Reduce heat generated on the inside.

* Turn off electric lights and appliances when they are not needed.

* Do not use the heated dry cycle on your dishwasher.

* Spread out use of such heat-producing appliances as irons and ovens.

* Avoid cooking or bathing, use of laundry equipment and dishwashers during the high heat hours.

Maintain the efficiency of your room air conditioner.

* Keep it clean inside and out. The filter

should be checked regularly and cleaned **before** it needs it. The condenser (outside coil) should be cleaned at least every two or three years.

* Do not restrict the air flow into or out of the unit either inside the room or on the outside.

* If you have a choice, locate the unit on the north or east side of the house, if possible.

* Be sure the unit is installed properly. Check your wiring to be sure the house circuit can provide the right amperage and voltage.

* Avoid operation during electrical "brown out" periods.

Do not use the unit more than necessary.

* Set the thermostat to a warmer temperature. A minimum 78°F is recommended.

* Turn the unit off and open windows when the weather is cooler or breezy.

* Close off unused rooms.

* Turn off the unit when the room is not going to be used for several hours -- or at least set the thermostat higher.

* Use the fan to draw in cooler, outside air. When cooling is required, do not set for outside air unless fresh air is needed.

* Use the fresh air and/or exhaust damper (if your unit has one) sparingly.

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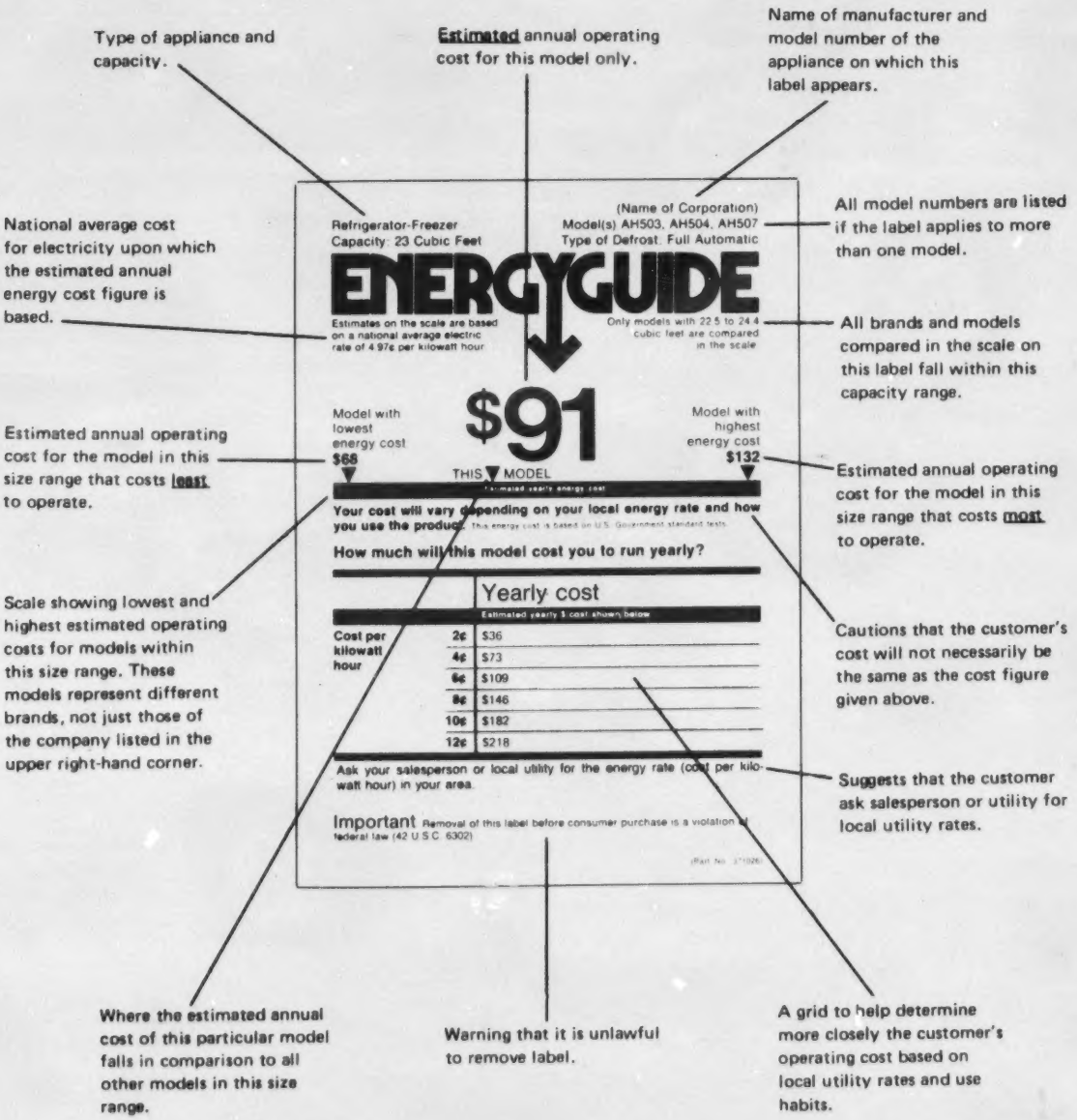
ENERGYGUIDE

Next time you shop for a major appliance, look for the new yellow-and-black EnergyGuide labels that will tell you the appliance's energy cost and will allow you to compare it to the energy cost of similar models. The EnergyGuide labels can help you save money because many energy-efficient products will cost less to operate over the long-run even through their initial purchase price may be somewhat higher.


Type of appliance and capacity.
Estimated annual operating cost for this model only.
Name of manufacturer and model number of the appliance on which this label appears.
National average cost for electricity upon which the estimated annual energy cost figure is based.
All model numbers are listed if the label applies to more than one model.
All brands and models compared in the scale on this label fall within this capacity range.
Estimated annual operating cost for the model in this size range that costs least to operate.
Estimated annual operating cost for the model in this size range that costs most to operate.
Scale showing lowest and highest estimated operating costs for models within this size range. These models represent different brands, not just those of the company listed in the upper right-hand corner.
Cautions that the customer's cost will not necessarily be the same as the cost figure given above.
Suggests that the customer ask salesperson or utility for local utility rates.
Where the estimated annual cost of this particular model falls in comparison to all other models in this size range.
Warning that it is unlawful to remove label.
A grid to help determine more closely the customer's operating cost based on local utility rates and use habits.
Refrigerator-Freezer
Capacity: 23 Cubic Feet
(Name of Corporation)
Model(s) AH503, AH504, AH507
Type of Defrost: Full Automatic
ENERGYGUIDE
Estimates on the scale are based on a national average electric rate of 4.97¢ per kilowatt hour
Only models with 22.5 to 24.4 cubic feet are compared in the scale
Model with lowest energy cost
$68
$91
THIS MODEL
Model with highest energy cost
$132
Your cost will vary depending on your local energy rate and how you use the product.
How much will this model cost you to run yearly?
Yearly cost
Cost per kilowatt hour
2¢ $36
4¢ $73
6¢ $109
8¢ $146
10¢ $182
12¢ $218
Ask your salesperson or local utility for the energy rate (cost per kilowatt hour) in your area.
Important Removal of this label before consumer purchase is a violation of federal law (42 U.S.C. 6302)

ENERGY TIPS

From Other States

Below are reprinted valuable tips originally published by energy officials in other states.

SCIENCE FAIR IDEAS

Prepared By
Robert Y. Ofoli
and
Lowell F. Rothert
for the
Michigan 4-H Youth
Energy Project
March 1978

1. Reading the electric or gas meter; (for one day with normal use and another day using conservation techniques).

2. Study energy savings in recycling paper, glass, etc.

3. Dripping water faucets -- study how much water and how much energy is wasted.

4. Study use of compost vs. commercial fertilizer for home gardening as it relates to energy.

5. Study gas mileage differences due to different driving habits. Try an experiment involving a round trip of 200 miles or more -- use same car, same route, but different drivers or techniques such as speed, etc.

6. A demonstration of the value of insulation; (home hot water heaters, walls, floors, etc. One sample insulated and one uninsulated -- study heat loss.)

7. Build a solar hot dog cooker and experiment with it.

8. Show ways of heating home hot water by solar energy.

9. Study heat-transfer (temperature) differences in various materials -- wood plasterboard, fiberglass, double-glazed windows, etc.

10. Rank household appliances' energy use from most efficient to least efficient.

11. Compare electric or gas meter-disk speed at your home for various times of day.

12. Design small windmills and study their operations -- windspeeds, rotary speeds, etc.

13. A demonstration of the difference between energy used by an incandescent light and a fluorescent light. (Can you measure how much light each is giving off?)

14. Study how gas mileage is affected by amount of air pressure in tires. (Is there a difference between types of tires?)

15. Build a model showing how to properly caulk or weatherstrip a home.

16. Experiment with direct electricity from the sun -- photovoltaics.

17. Make a list of energy-efficient ways to use an automobile.

18. Compare storm windows and doors to ordinary windows and doors as to their energy efficiency.

19. Compare gas mileages for several cars and rate them according to their efficiencies. (Obtain Environmental Protection Agency Ratings of Fuel Economy.)

20. An energy chain: select any item in your home, school or street. List the kind of energy associated with it. Does it transform energy from one kind to another? Does it store energy? What kind? What kinds of energy were used to manufacture it? What energy do you need to use it?

21. Make a list of the various sources of energy. Identify which sources are renewable and which are not.

22. Make a list of what kinds of energy will be most used in the future. Study the feasibility of each energy source.

23. Monitor the amount of electrical energy and/or gas energy used in your home for a week. Can you do this for several weeks and compare? Can you make a graph showing the comparison? Share this with your family and see if some conservation action is necessary.

24. Make a list of ways by which energy can be conserved in your home. Discuss this with your family.

25. Keep a record of how much driving the members of your family do in a week. Study ways of achieving family goals with less driving.

26. In cooperation with your parents, find out how much less your heating bill would be if the thermostat is turned down to 58-60°F at night.

27. Make a survey of energy attitudes of people you know.

28. Design and experiment with different types of solar collectors and compare their performances.

29. Design a house for optimum energy utilization.

30. Study per-capita energy usage of countries of the world, including the U.S. Compare the energy usage to per-capita income in these countries.

31. Plan a community for optimum energy utilization -- stores, houses, schools, etc.

32. Study the literature relating to energy reserves consumption. Predict when there will be serious declines in our reserves.

33. Find out how many kilowatt-hours of electricity it takes to operate your family's television set, stereo, etc. and calculate the dollar amount it takes to operate it for a year.

34. Compare microwave ovens to conventional ovens. Which costs more to operate? Which is more energy-efficient?

35. Compare cost and efficiency for home versus commercially-prepared food.

36. Do a study of leisure activities, ex. swimming, snow-mobiling, etc. and compare their use of energy.

37. Do a study of wood as a home heating fuel source.

38. Study the advantages and disadvantages of permanent press fabrics versus those that require ironing.

39. Compare the various types of food and the energy required to produce and process them. For example, meat protein versus plant protein.

40. Study infrared photography and look at its applications to heat sensing and energy conservation.

*

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SCHOOL TIPS
By The
Pennsylvania Energy
Extension Service

Programs

1. Develop an energy conservation plan.

2. Form an energy committee to look at energy consumption and possible ways to reduce it.

3. Assign an energy monitor for each building.

4. Maintain a history of energy consumption and costs.

5. Establish a preventive maintenance program for your school district.

6. Update the training of your maintenance and custodial personnel.

7. Develop an awareness among employees of the need to conserve energy.

Heating and Cooling

1. Establish a standard temperature setting for occupied and unoccupied time.

2. Turn down thermostats to temperature directed by School Board.

3. Calibrate controls, thermostats, and operators.

4. Insure that time clocks are properly set and changed at the proper times.

5. Establish a standard set-back temperature during unoccupied periods.

6. Adjust time clock to match weather conditions.

7. On HVAC system (heating, ventilating, air-conditioning) only allow the first heat zone to turn on automatically.

8. Do not begin heating the building too soon in the heating season (fall) nor continue too long in the spring when it warms up.

9. Shut down heating units completely when building is not occupied and there is no danger of freezing.

10. Turn down to night set-back before students leave depending on outside temperatures.

11. Turn down heat in unused areas of the buildings, especially at night, weekends, or when not in use.

12. Make sure the following are turned off at night, weekends and unoccupancy times:
a. Cooling or condenser fans
b. Chilled water and condenser pumps
c. Supply and exhaust fans
d. Cooling towers, fans, and pumps
e. Boilers which supply absorption units

13. Reduce rate of infiltration.

14. Do not block radiators, registers, or air flow to univents and window line heating units.

15. Limit the number of entrances students and teachers use for normal arrival and departure.

16. Keep doors closed in hallways.

17. Shorten time on door closers.

18. Reduce relative humidity levels.

19. If possible, consider waste-heat recovery.

20. Make full use of window shades, draperies, and blinds.

21. Close drapes at night during cold weather.

22. Protect occupants from exterior surfaces, for example; pull drapes, close venetian blinds.

23. Plant windbreaks.

24. Use the sun whenever possible.

25. Turn off cooling systems during unoccupied hours.

26. Turn off all unnecessary heat producing equipment in the cooling season.

27. Establish a cooling level of approximately 78°F.

Boiler Operations

1. Check for inefficient boilers.

2. If there is more than one boiler, operate it to the maximum before turning on the second boiler.

3. Keep flues clean in the boilers.

4. Insulate bare steam lines to reduce heat loss.

5. Maintain proper water level in boilers.

6. Check for steam leaks in lines.

7. If you heat by steam, make sure that steam valves do not leak and that the steam traps function properly.

8. Clean tubes on all boilers at regular intervals to obtain maximum operating efficiency.

9. Schedule boiler blowdown on fixed timetable.

10. Minimize boiler blowdown with a better feedwater treatment.

11. Smaller and more frequent blowdown quantities are preferable to larger quantities and less frequent blowdown.

12. Insure that boiler water is properly treated so that pipes are not coated with calcium or other impurities, which reduce the efficiency of the system.

13. Remove built-up scale in boilers and hot water heaters.

14. Use minimum steam operating pressure.

15. Turn off gas pilots for furnaces, boilers, and space heaters during the non-heating months.

16. Use warm exhaust air from adjacent areas, or from the ceiling of the boiler rooms, to preheat combustion air.

Ventilation

1. Shut down ventilation systems during unoccupied hours.

2. Reduce ventilation rates during occupied periods.

3. Close and cover baffles and vents on rooftop or window air-conditioners during the heating season.

4. Insure that outside air dampers fit properly and do not leak cold air when closed.

5. Close off univent intakes in cold weather.

6. Establish a policy of zero ventilation during unoccupied periods.

7. Turn off exhaust fans in toilets, kitchens, and labs when not in use.

8. Clean all filters often.

9. Insure all air filters are cleaned or replaced when they become loaded with dust.

Retrofitting

1. Additional insulation.

2. Use caulking and weatherstripping where needed.

3. Add storm windows.

4. Consider replacing old, poorly-fitting windows with other than glass, or reducing the amount of glass area.

5. Consider making vestibules at the heavily-used entrances.

6. Make sure that doors fit tightly or are weatherstripped.

7. Add drop ceiling where practical.

Hot Water Heaters

1. Reduce temperature for hot-water heaters except where needed for dishwashers.

2. Reduce hot-water use in showers by using flow restrictors.

3. Insulate hot-water storage tanks and pipes carrying hot water.

4. Turn off domestic hot-water circulating pumps when not required.

5. Turn off hot-water heaters during vacation periods.

6. Make sure that hot-water booster heaters are off during the summer vacation.

7. Install independent hot-water heaters to allow complete shutdown of boilers in summer.

8. Check plumbing for leaks, especially the hot-water system.

9. Flush and clean hot-water heaters every year.

Lighting

1. Use 34-35 watt fluorescent lamps in place of 40 watt lamps.

2. Reduce lighting in hallways and corridors to the minimum.

3. Replace incandescent with fluorescent lighting or mercury vapor.
4. Keep lighting fixtures and lamps clean.

5. Reduce light levels in supply areas, storage areas, hallways, and corridors (only 20 foot-candles required).

6. When you leave a room, turn off the light -- 7 to 10 minutes for fluorescent, immediately for incandescent results in savings.

7. Turn off lights in unused areas.

8. Install timers on light switches in little-used areas.

9. Use photoelectric cell to control outside lights.

10. Paint with colors that reflect light.

Kitchen Procedures

1. Preheat ovens for a minimum amount of time; do not allow ovens to remain on warm for long periods. Reduce heat as soon as possible.

2. Cook by time and temperature for best results. Use minute timers for precise cooking operations.

3. Don't open oven doors more than necessary to check foods being prepared.

4. Keep pots and pans covered while cooking whenever possible.

5. Match pan size to burner unit size.

6. Use small amounts of water whenever possible; they heat faster.

7. Insure that refrigeration heat exchanger surfaces are cleaned on a regular basis.

8. Exhaust only enough air from kitchen areas to reduce food smells -- slow down the fans, for example.

9. Eliminate use of electric can openers.

Activities

1. Add energy conservation to the curriculum.

2. Consider scheduling all nightime activities in one building, or as few buildings and wings as possible.

3. Schedule adult education programs to meet in rooms that receive full use during the day to use the existing room heat.

4. Conduct basketball and volleyball outside as much as possible and during daylight hours.

5. Eliminate refrigerators in science labs or classrooms where not absolutely essential.

6. Use kilns only when you have a full load.

7. Curtail use of resistance-type electric equipment, such as space heaters, coffee pots, and hot plates.

Other

1. If you are on a demand-rate schedule, be sure that the peak demands are under control.

2. Schedule major electrical power-consuming operations such as pumping water into storage tanks during off-peak hours when possible.

3. Check fans, motors, pumps and compressors for belt slippage and free bearings.

4. Do as much cleaning as possible with cold water.

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ENERGY CHECKLIST FOR BUYING A HOME

Prepared By the Wyoming Energy Extension Service

Wall-to-wall carpeting? Four bedrooms? Maybe a den? You are in the market for a new home and you have a list of all the necessary and special items you want included in that home.

But there are other considerations too . . . down payment, monthly carrying charges, mortgage payments, taxes, insurance . . . and utility costs.

A thorough look at the energy efficiency of the home you are considering buying may help you pay for those special items. Saving energy, you see, saves money.

ENERGY CHECKLIST

Landscaping: Is the house shaded from the hot summer sun by trees or some other means such as awnings? And not shaded in the winter -- to let the sun do some of the winter heating for you?

Is the house protected from the prevailing winds by trees, vegetation or some other windbreak?

Air infiltration: Is there weatherstripping around windows and a door between a heated space and an unheated one? Is the weatherstripping in good condition?

Is there caulking around door and window frames, water faucets, electrical outlets or other openings or cracks in the basic structure? Is the caulking in good condition?

Are all windows either double-pane glass or equipped with storm windows?

Are there doors to the outside thermal doors?

Insulation: A flashlight and a ruler or measuring tape could help you check out how much, if any, insulation is in the house already. In older homes, those built before 1970, don't be surprised to find there is no insulation.

Heating costs were not a substantial part of the investment then. In newer houses or ones under construction, expect to find 6 to 12 inches of insulation.

The attic: Is there any, and what type of insulation is installed . . .

between the ceiling joists? How deep? Uniform throughout?

(WEES recommends an approximate batt depth of 9" or an R-value of 30.)

in the attic walls?

(3" batt insulation is recommended here, with the vapor barrier facing the interior of the room, if attic is heated.)

In the case of a vaulted or cathedral ceiling, roof sections should be constructed of 2 x 6's which will provide area for 5" insulation batts above the ceiling and under the roof.

While you are in the attic, check to see that attic eave vents are free from material to insure necessary attic ventilation.

The walls: Unfinished rooms or garages may have insulation but uncovered walls make inspection easier. Is there any and what type of insulation is installed?

Is the vapor barrier of installed insulation properly facing the interior of the heated room?

Is the vapor barrier torn at all, decreasing insulation efficiency?

Are the installed batts straight and smooth, not buckled?

Are staples placed close enough together to support the batt?

For the walls of finished areas, ask either the owner or builder to demonstrate the type and thickness of installed insulation . . .

or remove the cover plate from one or more electrical outlets located on outside walls and check if there is any insulation around the outlet box. If a cold draft can be felt and no insulation is visible, this is generally a sure sign there is no wall insulation.

(WEES recommends R-13 insulation value for walls.)

The crawl spaces: Is there any ground cover, or sheets of plastic, spread and overlapped to form a moisture barrier, installed in the house crawl space? What type and how much insulation is installed . . .

between the floor joists?

(WEES recommends floors to be insulated to a minimum of R-19.)

Are heating and cooling ducts properly taped and insulated? If they are, it's a good bet you are talking to an energy-conscious home owner or builder.

Are there vents in the crawl space to insure proper moisture control and maximize the performance of the insulation? Four vents, one in each direction, are recommended.

If the home is built on a concrete slab, is there insulation installed around the perimeter of the slab, and a ground cover laid under the slab for moisture control?

Heating system: Ask the owner or builder if there are any energy efficiency advantages to the home's heating and cooling system. Check the limits on maintenance contracts or manufacturers' warranties on the system.

Is the home heating system controlled by one thermostat? Multiple thermostatically controlled zones offer flexibility so unneeded rooms may be closed off.

Is the thermostat timed to automatically lower the temperature during low heating hours of the night?

Appliances and equipment: Besides attic and crawl space ventilation, are there vent fans for the kitchen, laundry and bath to provide moisture and odor control in the home?

If it is a new home, are major appliances energy efficient?

Are lights equipped with solid state dimmer switches?

Fireplaces and woodstoves: If the home offers either of these alternative or auxiliary heating sources, check to see . . .

if the chimney is clear and recently cleaned,

if the fireplace damper fits tightly,

if there is a good supply of outside air for combustion,

if the woodstove adheres to minimum requirements for a safe operation.

(WEES offers the Fact Sheet, "Woodstoves: A Safety Checklist," for more information on this subject.)

Water system: If the water heater is located in an unheated area such as a basement or garage, is it well-insulated?

Are there any leaky faucets? Tight faucets conserve water and save money. A typical steadily running leak can waste over 6000 gallons per year, at a cost of an extra $3 or more on monthly gas and water bills.

Do faucets have flow controls on them? Restrictors can reduce flow at the showerhead, for instance, to 2 1/2 gallons per minute from the average 9 to 10 gallons.

Miscellaneous: Are window drapes heavy or well insulated to keep winter winds out, and the summer cool in?

Check the fuel and utility bills on an existing home to give you an idea of what costs to expect. Keep in mind those costs are influenced by behavior patterns such as thermostat setting, the number of clothes or dishwasher loads per week, and the number of people going in and out of the house, etc.

For newly constructed homes, you can check with other owners in the area who can provide some clues about energy costs, or advantages/disadvantages to the systems used in the home.

Or you can check with the local utility company where you may be able to obtain a reasonable estimate of the energy costs based on the square footage and thermal efficiency of a particular new home. The builder may have already adopted special "Energy Efficient Home" construction techniques and would be able to provide that information immediately.

For additional information, contact your Regional Director.

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ENERGY CONSERVATION IN THE RURAL HOME

The cost of operating your mobile home affects your budget. The comfort level affects your health. These are major considerations as you look for ways to save energy in heating and cooling it.

Heat is lost from your mobile home through ceilings, floors, windows, and walls. More than half of this loss is through ceilings and roofs. Ten to 20 percent is through floors. Windows and doors lose heat through con-

duction. Infiltration of air through cracks and holes robs you of still more heat. In the summer you lose air conditioning comfort in the same ways as heat is lost in the winter.

Look For The Label

If your home was manufactured before mid-1976, check the main places where heat is lost. If the manufacturing date is later, look for an indication (a label permanently attached on an interior wall) that it was built according to Mobile Home Construction and Safety Standards issued by the U.S. Department of Housing and Urban Development (HUD), effective June 15, 1976. A mobile home built according to HUD standards meets basic requirements for condensation control, air infiltration, and thermal insulation (in the ceiling, walls and floors). Some homes exceed minimum HUD performance standards for thermal protection and are labeled as "Energy Conserving Homes." They receive a HUD heating and cooling certificate. If you find nothing to indicate thermal protection, then retrofit (winterize) the mobile home yourself.

Locate For Safety and Warmth Or Shade

How your home is placed (oriented) on its site will determine its comfort and safety. First, locate your home to protect it from strong wind. Second, take advantage of the sun's warmth in cold climates or of shade in hot zones. Come as close as you can to the suggested ideals:

1. If wind safety permits, locate the long sides of the home to face north and south. Otherwise, the home will be warmed unevenly and light coming through west windows will be a problem.

2. Face kitchens east, or at least not west.

3. Windbreaks are needed most along north and west sides. Use something like:
* a semi-enclosed carport
* large evergreen shrubs
* evergreen trees that hold their lower limbs
* a tall fence

4. Shade the south side in summer by using:
* awnings
* porches

5. Plant deciduous trees on the east, west, and south sides of the home.

With the home properly sited and placed on a firm foundation, tie it down carefully. Use the straps the manufacturer supplies, or secure the home with the correct number of over-the-top straps. Anchoring specifications are readily available from dealers, installers, or the Cooperative Extension Service in your county. Shortcutting this step endangers the lives of family members and leaves the home vulnerable to being wrecked by windstorms.

Insulation

First, insulate overhead, where the greatest heat loss occurs. A urethane foam material 3 or more inches in thickness may be sprayed (on the roof only) and then topcoated with a protective liquid glass sealer to prevent discoloration and deterioration.

Cooling comfort can be increased through the use of cool seal reflective roof coating. This thick fibrous substance contains aluminum particles that migrate to the surface as the coating dries. A good thick coating is needed.

A note of caution; check the original coating material on your roof. Foam insulation will not stick to some coatings and an insulated false roof will have to be constructed in those instances.

Second, install fiberglass batts beneath the floor. Buy batts with a vapor barrier and place the vapor barrier toward the inside of the home. Keep the batts in place by attaching chicken wire to the joists. Use the R-value of insulation recommended by your power company or the Cooperative Extension

Service in your county.

Weatherstripping and Caulking

Weatherstripping and caulking are next.

Put weatherstripping around all windows and outside doors, filling in cracks. Double-check the threshold portion of outside doors. Don't leave a crack between the bottom of the door and the threshold. Wear sometimes causes a crack to develop.

Caulking requires detective work. Air leaks and cracks not only increase the cost of heating and cooling, they let in damaging moisture. Check carefully around molding, joints, nails, screws (especially in the siding panels), splash panels, windows, top seams, doors, roof vents and wheel housing. Seal all openings each year with a quality caulking compound. You can buy caulking in a variety of colors to match exterior colors. Use roofing cement on roof seams and around roof vent stacks.

Storm Windows

You can add an extra layer of protection to windows simply by taping a layer of 4 to 5 mil polyethelene over them. This is transparent "builders plastic." Use pressure sensitive masking or duct tape and place it along the entire clean edge on all four sides. This extra layer is useful even with storm windows; it adds the effect of triple glazing.

Skirting

If you have never gotten around to skirting or underpinning your home, do that, too. Skirting cuts drafts, aids insulation, and keeps high winds from producing an uplift effect on the home that can be damaging and dangerous. You can use corrugated metal or plastic as well as concrete blocks and brick.

Temporary skirting with hay bales or bagged leaves causes problems, for they may shift accidentally and close up necessary vent spaces. They are also a fire hazard since they ignite easily. It is better to use a more permanent noncombustible material. If the home has an underfloor burner for heating air or water, be sure that adequate openings are left in the skirting to supply fresh air for combustion.

About six 8-by-16-inch vents should be placed in the skirting to allow ventilation. One on each end, two along the front, and two along the back sides will probably do an adequate job. A panel should be built to maintain equipment underneath the mobile home. Vents should be placed no closer than 4 or 5 feet to a water line, but one vent should be placed as near as possible to the air intake of the furnace. Exposed water pipes -- especially hot-water pipes -- should be wrapped with pipe insulation that is fitted and taped carefully over the full length of the exposed area. If heating ducts beneath the floor are not insulated, they should be. Use a minimum R-4 special duct insulating blanket and tape it in place.

The Thermostat

Reducing thermostat setting can save as much as 3 percent of fuel costs per degree Fahrenheit. Try these:

Heating Season
65° - 68°F
Adjust downward 5° - 10° at night

Cooling Season
10°F below outside temperature but no lower than 78°F.

If winter humidity can be controlled -- try for a 50 percent humidity level. Keep it low enough to avoid window condensation problems. A little moisture can be added in the winter by carefully placing pans of water through the house for evaporation, but a furnace humidifier gives the most satisfactory results.

Maintenance

Take all the measures we have just discussed. Than carefully and systematically check items at least once a year.

*

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Fact Sheets In The
Home Weatherization Series

1. Why Weatherize Your Home?

2. How To Determine Your Insulation Needs

3. Save Heating And Cooling Dollars With Weatherstripping And Caulking

4. How To Save Money With Storm Doors and Windows

5. What to Look For In Selecting Insulation

6. How To Install Insulation For Ceilings

7. How To Install Insulation For Walls

8. How To Install Insulation For The Floor And Basement

9. Solving Moisture Problems With Vapor Barriers And Ventilation

10. Weatherize Your Mobile Home To Keep Costs Down, Comfort Up

11. Tips On Financing Home Weatherization

12. Keeping Home Heating And Cooling Equipment In Top Shape

13. Landscaping To Cut Fuel Costs

14. Home Management Tips to Cut Heating Costs

15. Locating New Home Sites To Save Fuel

Single copies are available upon request to Special Reports Division, Office of Governmental and Public Affairs, U.S. Department of Agriculture, Washington, DC 20250.

This series of fact sheets was assembled from research, Extension and other sources by the USDA Task Force on Weatherization.

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ENERGY: AUDUBON'S ANSWER

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The Energy Crisis boils down to three questions: How much energy do we need? Where are we going to get it? How much are we willing -- or able -- to pay?

Our government and the energy industry keep coming up with the same answers: we need an ever-increasing amount of energy; we should get it by developing domestic energy supplies to the fullest; and we should pay whatever it costs, both economically and environmentally. These conclusions are based on the assumption that continued growth in America's economy is essential, and that such growth and a rising standard of living are inextricably linked to growth in energy consumption. Ergo, unless we are willing to tolerate very high levels of expensive oil imports -- levels which may make our political and economic independence hostage to the whims and ambitions of a few oil-rich countries and draw us into military and diplomatic quagmires -- we have no choice but to follow the road of full-scale development of domestic energy sources.

According to this logic, we must search desperately for more domestic oil and gas; we must proceed headlong with nuclear power development; we must strip-mine more coal;

we must produce synthetic fuels from coal and wring the oil out of shale and tar sands. Never mind how much these undertakings will cost; how much damage they will do to human health and to the environment upon which our health, wealth, and happiness ultimately depend. We have, according to the government and the energy industries, no realistic alternative.

The Audubon Energy Plan is one such alternative. It is a practical proposal for assuring ourselves of sufficient energy in the future to produce more goods and services than we do today, providing a higher standard of living for a larger population. And it demonstrates that economic growth need not be linked to energy growth and its resulting environmental degradation.

Unlike virtually all government and industry forecasts, the Audubon Plan proposes to hold total energy demand constant by increasing our energy efficiency, using existing and incipient technology to get more work out of the familiar fuels we are using now. In addition, the Audubon Plan relies on the inexhaustible energy of the sun, tapped by available or emergent technologies, to supplement and eventually supplant 25 percent of our traditional energy by the year 2000.

The Audubon Plan is the work of National Audubon Society scientists, using the best and most current data from academic experts, government agencies, and energy companies. In its present form, the plan has been strengthened by suggestions from many of the country's foremost energy experts. As better, newer data become available, the plan will be revised. Meanwhile, the plan will be improved by public discussion at all levels of our society, until the issues it raises are addressed in a national energy policy that can command the support of American citizens and their elected leaders.

The energy problem -- a short course: There is no disagreement between the Audubon Plan and other energy proposals on the nature and source of our present predicament. When energy -- especially oil -- was plentiful and easy to get, therefore cheap, we quite naturally got into the habit of using a lot of it; more than we needed to, and more than some other countries use to support similar, even superior, standards of living. We abandoned fuels that were harder to get at and messier to burn in favor of oil, which we now use not only for transportation, for which it is uniquely useful, but also for generating heat and electricity, for which it is not.

With the depletion of our easily recoverable domestic oil reserves, we have turned increasingly to imported oil, placing our economic and military survival in jeopardy. We are not alone: most of the industrialized countries, and a growing number of the developing countries as well, are hooked to the same international oil pipeline. It was inevitable that the oil exporting countries would sooner or later form a cartel to exploit the situation by controlling oil supplies and multiplying prices, putting the rest of us over a barrel.

The results of our folly are now manifest. We pour tens of billions of dollars annually into purchases of foreign oil, with no hope of relief, while we live in constant fear of shortages dictated by decisions and events in far-off lands. Our diplomacy, foreign policy, and military strategy are distorted by petropolitical considerations. At home, we are tempted by ill-considered, extravagantly expensive energy-development schemes, without rational regard for their economic, social and environmental side-effects. The Audubon Plan proposes to eliminate the effects of the energy crisis by dealing directly with its causes: our failure on the one hand to moderate our demand for, and waste of, energy, and on the other hand to develop energy supplies from renewable sources that are not subject to interdiction or exhaustion.

The demand side of the equation: On the demand side, the plan's point of departure is a calculation of the total amount of energy

in various forms needed in the United States by the year 2000 to provide a generous, modern standard of living. Recent studies by energy companies, private-sector research organizations, and federal agencies arrive at widely divergent projections of total United States energy demand 20 years hence. In terms of quads -- the quad is a standard measure of energy equal to one quadrillion (10^{15}) British thermal units, the equivalent of 500,000 barrels of oil per day for one year -- the projections for the year 2000 range from 57 quads all the way to 122, or from 25 percent less energy than we use today to 50 percent more. The divergence of these projections reflects both future technical uncertainties and the influence on energy demand that different government energy policies can have. Audubon's figures for future energy demand are conservative, based on work by individuals and organizations with no clear "environmentalist" affiliation. The demand figures have been chosen to allow for a substantial margin of error, and to allow for unanticipated shortages on the supply side. With all these caveats, Audubon scientists have pegged 80 quads as a reasonable target for the total United States energy demand in the year 2000 -- about the same as our energy demand in 1981.

The plan's central premise is that the same amount of energy can be used more efficiently and productively to provide a more abundant, healthier, and happier life than we enjoy today. The idea that a constantly rising standard of living can only be sustained by ever-increasing energy consumption has been preached as gospel by the energy establishment for so long that it has become part of the common wisdom. The example of other Western, industrialized countries demonstrates, however, that it is possible to provide standards of living equal or even superior to our own with far lower per-capita rates of energy consumption. The enviable, high-quality technological comforts enjoyed by our European cousins testify that a moderation in our own energy demand need not entail a return to the simple life.

Rather than a renunciation of the high standard of living enjoyed by most Americans today, the Audubon Plan calls for renunciation of profligate energy use. If we replace and retune our technology -- our cars and houses, our machines and factories, and everything else that uses energy -- we can get more work out of every barrel of oil and ton of coal that we use. As a result of such an increase in our energy efficiency, according to Audubon calculations, by the year 2000 we can produce as much as 50 percent more goods and services than we do today without using any more energy. With 80 quads of energy, we can have as many goods and services as would require 122 quads today, and a healthy economic growth rate of 2 to 3 percent per year for the next 20 years. At the same percent, balancing the anticipated 25 percent growth in the efficiency, we can get more for less. The Audubon Plan calls not for doing without, but for doing it better.

The energy efficiency required by the Audubon Plan will come about through a combination of factors. What's needed is the working of natural market forces plus regulations, incentives, and education to encourage energy-efficient appliances, higher auto-mileage standards, energy-saving standards for new buildings and the required retrofitting of old ones before resale. About half of the targeted 40 quads of energy savings from improved efficiency will come about without any regulatory interference in the marketplace, prompted by the increasing cost of energy. In particular, the industrial sector of the economy, which accounts for fully 50 percent of the nation's energy demand in the Audubon Plan for the year 2000, as compared to 37 percent today, already is acutely sensitive to the effect of energy prices. Virtually ignored as insignificant for decades, energy now is recognized along with labor as a major factor in the cost of production. There is no industry that is not already committed to major investments in energy-conserving technology.

Demand-suppressing effects of higher energy

prices also are visible in transportation, which today accounts for most of our oil consumption. Gasoline consumption has fallen 13 percent in only two years, back to the level of 10 years ago. Nevertheless, the Audubon Plan requires supplementing effects of higher prices in the transportation sector, which is projected to represent 25 percent of the total energy demand in the year 2000, with mileage standards that are more strict than present ones. An increase in the fuel efficiency of our automobiles from an average of 15 miles per gallon to 30 miles per gallon, along with similar improvement in our fleet of light trucks, would bring us well along the way to reducing the flood of foreign oil to a trickle. Audubon scientists estimate that an increase in mileage standards to an EPA rating of 37.5 miles per gallon will be necessary to reach this goal. Many of the latest automobiles, domestic as well as imported, already approach the 37.5-mile-per-gallon EPA rating and can easily exceed it long before the turn of the century.

Reductions in demand also can be foreseen in the buildings sector, due to improvements in insulation, heating systems, air-conditioning, and domestic appliances. The Audubon Plan projects a 25 percent increase in the number of buildings by the year 2000, but a decline in building energy demand. The projected decrease in energy consumption in buildings will come about as a result of higher prices, supplemented by a small number of specific regulatory changes -- including the requirement of appliance and building energy standards -- and novel methods of providing credit for the financing of major efficiency improvements.

A 30 percent growth in the demand for electricity by the year 2000 will be met by an increase of just 10 percent in centralized electricity production. This seeming paradox is the result of increases in on-site generation, particularly in industry.

The supply side: To supply the nation's demand for 80 quads of energy in the year 2000, the Audubon Plan relies on 20 quads of renewable solar energy in various forms. Some 9 quads of energy -- almost half of the solar energy in the plan -- will be derived from biomass: wastes from plant and tree crops, crops grown especially for sustained energy production, and garbage and other organic wastes.

Biomass can be burned to provide energy, or it can be turned into methanol and ethanol fuels. With its tremendous agricultural and forest production and its staggering production of organic wastes, the United States has a very large potential for biomass energy production. In the nation's commercial forests alone, for example, the annual growth of tree biomass has an estimated energy value of 15 quads. Only one-third of that is harvested today, but under proper land and forest management the yield could be increased substantially without impinging on wilderness areas or other non-commercial woodlands, and without diverting timber from the forest products industry.

There is sufficient evidence from the United States and Europe that forests can be managed to produce a sustained annual yield without suffering significant damage. No such evidence exists for other ecosystems, such as wetlands, that have great potential as sources of biomass energy. The Audubon Plan, therefore, does not include energy from these areas. Also, to avoid potential competition with food demand, the plan does not contemplate significant use of food-quality biomass to produce alcohol fuels.

Wind energy, primarily from 50,000 large, utility-owned turbines, will contribute 2.4 quads to the nation's energy supply by the year 2000. To get this much energy from the wind, we will have to tap only about 3 percent of North America's high-wind potential. We can increase our existing hydropower by almost 1 quad, according to the plan, simply by installing turbine generators in existing single-purpose dams, without building any new dams or flooding any additional land, using only half the existing dams. More than 4 quads of the solar energy in the Audubon Plan

will come from low- and medium-temperature solar heat collectors used to heat space and water. Less than 1 quad will come from photovoltaic cells, which produce electricity directly from sunlight.

The Audubon Plan has little or no need for the exotic, costly, and dangerous energy schemes that are advanced as technological miracle cures for the energy crisis by some members of the energy establishment. The plan includes only 25 percent as much energy derived from synthetic fuels as is forecast by the U.S. Department of Energy. Oil from shales and tar sands, despite the hopeful forecasts of the government and the oil industry, does not figure at all in the equation because of the unacceptable economic and environmental costs associated with these still-unproven technologies. The conversion of coal to liquid and gaseous fuels, another major contributor in many energy forecasts, figures in the plan only in relatively small plants which can produce low-Btu gas from coal to generate heat and electricity for their own consumption. No geothermal energy is included in the plan, pending a careful review of its environmental effects.

With various forms of solar energy supplying about 20 quads in the Audubon energy budget, the remaining 60 quads -- 75 percent of the total -- remain to be derived from traditional, nonrenewable sources. Oil will provide about 20 percent -- 16 quads -- of our total energy, compared to 44 percent today. Oil imports will be only one-quarter of their present level. Most of this imported oil will come from the Western Hemisphere, posing a tolerable security risk.

Reluctantly, but realistically, the Audubon Plan projects significant increases by the year 2000 in the use of coal and nuclear fuels. The increases foreseen by Audubon, however, are modest compared to those urged by government and industry. The Audubon Plan assumes that no new nuclear plants will be liscensed and begin construction, only two-thirds of those currently under construction will actually come on-line, and several existing plants will be shut down because of accidents or public opposition. Nevertheless, Audubon concludes that nuclear power production will virtually double to 6.6 quads by 2000. Thereafter, nuclear energy's share gradually will decrease as old plants are decommissioned.

Coal combustion contributes fully 28 percent of the Audubon Plan's total energy supply, a 40 percent increase over its present share. The plan provides, however, that coal mining and combustion include the best available land reclamation and pollution controls. Even so, the plan embraces coal only as a transitional fuel until sometime in the next century, when renewable energy sources (including photovoltaic conversion) will be sufficiently developed to supplant coal to an increasing extent. Meanwhile, the current Audubon Plan assumes conservatively that only 15 quads of natural gas will be available in the year 2000. Any available gas in excess of this estimate will replace coal, avoiding some of the human and environmental costs associated with coal mining and combustion.

Conservation costs and benefits: The introduction of energy-efficient technologies throughout the American economy to limit total energy demand to 80 quads while producing more goods and services will require a capital investment of some $700 billion over the next 20 years. The average annual investment of $35 billion is only 10 percent of our total annual expenditure for energy of $350 billion; and it appears is much less than the cost of increasing our energy supplies to support a continued growth in demand, as urged by government and industry. The Audubon Plan's proposals for saving energy by increasing efficiency will cost less than developing new oil and gas supplies; less than producing synthetic fuels; and less than building coal-burning and nuclear powerplants to produce electricity.

The only other alternative, increasing our oil imports as domestic production declines and

demand increases, would of course require no new capital investment. In the long run, however, it would prove the most expensive course of all. By the year 2000, assuming that the price of a barrel of oil rises to $50 in 1980 dollars (it has already reached $40 on occasion in some markets) we would be paying $350 billion per year to purchase 40 quads of imported oil. The total cost of improving our technology to eliminate forever the need for those 40 quads is only $700 billion, or twice the annual cost of importing it. Moreover, all of the money we spend to increase our energy efficiency will stay at home creating jobs and domestic capital, instead of swelling the already burgeoning treasuries of the OPEC countries.

Synthetic fuels derived from coal are expected to cost as much as oil. At $50 per barrel, using either of these liquid fuels to supply 40 quads of energy would cost about $3.5 trillion by the year 2000 -- five times the cost of energy conservation. The Audubon approach also is cheaper than relying on electricity generated by coal or nuclear fuel. The coal or nuclear fuel would have to be used in 700 additional 1,000-megawatt powerplants built during the next 20 years at a cost of about $1 trillion -- $200 billion more than the cost of conserving energy in the Audubon proposal.

Despite rhetoric to the contrary, we do not have the option of replacing imported oil with increased domestic production from new or existing fields. Petroleum production in 48 contiguous states and offshore peaked in the early 1970s. Even with the subsequent increase in exploration and drilling and the improvement of recovery techniques stimulated by rising oil prices, most experts expect domestic production to continue its gradual decline. The addition of oil from Alaskan fields can only delay the inevitable. The various schemes proposed for increasing domestic production through so-called tertiary recovery are so costly -- and risky -- that they can be justified only by pricing the new energy at the exorbitant levels set by the OPEC cartel. Even if these schemes were successful, therefore, domestic oil would cost as much as imported oil, and far more than improving our technology to use less energy in the first place.

In addition to the capital investment in energy-efficient machines, buildings, and industrial processes, the Audubon Plan requires the investment of some $570 billion over the next 20 years -- $130 per person each year -- in solar energy. This investment would be cheaper than relying on oil, nuclear power, or gas. Solar collectors to provide heat and hot water for homes and other buildings make up almost half of the total investment in solar energy in the plan. The capital cost of such installations, like the cost of many other conservation measures, such as insulation, can be provided by a lending institution as part of the building's mortgage financing, or by a local utility, which would add monthly principal and interest payments to the customer's bill in the same way that the costs of fuel and generating facilities are added to electric bills today. Utilities in California are already pioneering as lenders for solar energy and energy conservation projects. The availability of credit to finance energy-efficient technology and solar energy systems is an essential element of the Audubon Plan. It is the only way that these technologies can be made financially attractive enough to appeal to all income groups in American society -- the only way that these technologies can be expected to reach most American households in the next two decades.

According to strict cost-versus-benefit calculations, we will save money in the long run by investing in energy efficiency and solar-energy technology, instead of endlessly increasing our supplies of traditional, nonrenewable energy. The Audubon Plan has more than its purely economic virtues to recommend it, however. All energy programs entail environmental costs which are not taken into economic account: strip-mining, especially in the ecologically-fragile western coalfields; air and water pollution resulting from the production and use of virtually all nonrenew-

able fuels; acid rain from fossil-fuel combustion; and nuclear wastes, not to mention the uniquely frightening potential of lethal pollution from nuclear accidents. The Audubon Plan reduces the need for such unwise, costly, and unnecessary energy developments. Moreover, the more modest new energy developments called for in the Audubon Plan, such as biomass combustion, will include the most effective pollution controls and other environmental protection measures from their inception.

Toward transformation: Economic and environmental considerations coincide in favor of the Audubon Plan. The promoters of expensive energy-supply schemes such as synthetic-fuel and nuclear power development have no justification for claiming that their projects merit public support and huge subsidies simply because we have no alternative for avoiding energy starvation. In fact, their schemes divert the very human and financial resources required to renovate our energy economy toward efficiency and solar energy.

Nevertheless, the technological and economic transformations called for by the Audubon Plan are profound and extensive. But Americans are used to change; we thrive on it. By the year 2000, in the ordinary course of things we will have replaced most of our consumer goods, automobiles, household appliances, and other machines. Much of our housing stock and industrial plant will have been renovated or rebuilt. As we shop for a new generation of capital and consumer goods, the increasing cost of energy will influence our choices toward technologies that are more energy efficient and that use solar energy. The marketplace will respond by making things like improved insulation materials and solar collectors as common in stores and catalogs as refrigerators and electric water heaters are today. And as we invest in goods that have lower energy costs, we will also be providing a healthy stimulus to the American economy.

Regulations, laws, and public education all have supplementary roles to play in encouraging the conservation and solar-energy development necessary for meeting the Audubon Plan's goal of 80 quads. Perhaps equally important will be the influence of individual American citizens. As individuals, we can do our utmost to conserve energy and reduce waste and look for solar-energy opportunities in our personal lives. As citizens, we can encourage the political choices that must be made at the local, state, and federal levels to turn our society away from its tradition of endlessly increasing energy supply and consumption toward the policies suggested by the Audubon Plan.

We can, for example, audit the energy policies of our own states to make sure that they include heavy doses of conservation and solar-energy, that they encourage state-chartered banks and utilities to finance energy improvements by their customers, that they require state agencies to set minimum standards for energy efficiency and consumer energy information on all appliances. We can press the leaders who court our support to stop spending our tax dollars on subsidies for misconceived and wasteful synthetic-fuel programs and nuclear power projects. We can encourage them to support practical mileage standards and speed limits for automobiles.

Through such efforts, we have the opportunity to choose the energy program for our next crucial decade.

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A 100-page technical report on the Audubon Energy Plan is available upon request from:

Energy Plan
National Audubon Society
950 Third Avenue
New York, N.Y. 10022

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ENERGYGRAMS

Energygrams; Brief Descriptions of Energy Technology is available for $30 annually from:
National Technical Information Service
U.S. Department of Commerce
Springfield, VA 22161

The publication is prepared by the Technical Information Center of the United States Department of Energy, and four issues are published each year.

Below are sample bulletins published by *Energygrams*.

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Fuel From Farms

This technical note was based on research conducted by the Solar Energy Research Institute.

Farmers may find small-scale production of alcohol (ethanol) a profitable venture, according to a report published by the U.S. Department of Energy. Ethanol can be used to fuel farm equipment or marketed for "gasohol" production and as an industrial chemical. Moreover, the protein-rich residue from ethanol production can be sold as an animal feed additive.

Ethanol can be produced from a variety of crops, such as sugar cane, sugar beets, sorghum, Jerusalem artichokes, corn, wheat, and potatoes, for example. Often, the chaff from the feedstock can be burned for process heat.

The major portion of the investment is in equipment needed for feedstock handling and storage, heating to convert carbohydrates to simple sugar, fermentation, distillation, ethanol drying, and stillage (byproduct) processing. This can be financed by banks, foundations, public agencies, or other private sources. The operation can be set up strictly for profit and/or to reduce the fuel costs of the farm. Specific regulatory requirements for operating the distillery are listed in the report.

Usually an ethanol farm will be part of an ordinary farm. The ethanol feedstock crops can be rotated with conventional crops; and often the tasks required for ethanol production can be combined with ordinary farming activities, so that additional help is not needed. A small-scale ethanol processing plant can be operated by one person and requires attention only two or three times a day.

SERI/SP-451-519

This report is available from:
Technical Information Center
U.S. Department of Energy
P. O. Box 62
Oak Ridge, TN 37830
Attn: Fuel from Farms

National Alcohol Fuel Information Center
Hotline Solar Energy Research Institute
1617 Cole Boulevard
Golden, CO 80401
(800)525-5555
(800)332-8339 (for residents of Colorado)

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Fuels and Chemicals From Sugar Crops

This technical note was based on a review conducted by Battelle, Columbus Laboratories, for Conservation and Solar Energy.

Sugar cane, sweet sorghum, and sugar beets were evaluated as renewable sources of fuels and chemical feedstocks. To place alternatives in perspective, the substitutability of sugar-crop products for nonrenewable resources was examined in the context of the overall United States energy-production scheme.

Sugar-crop systems are advantageous in that

much of the biomass is in readily fermentable sugars that are convertible into alcohols. Bagasse (fiber residue) can be burned as a fuel or further processed. Sugar crops have high yields per unit land area, low pollution during processing, and shares costs with food products.

Energy-balance, environmental, technological, geographical, and economic factors are considered for the various primary and secondary-conversion processes in fuel and chemical production, both for main products and byproducts.

Principal economic findings do not justify a large-scale conversion to energy and chemical production from sugar crops. Nevertheless, the review recommends research and development in the processing of sugar cane into chemical feedstocks and fuels, on account of the low unit costs for fermentable sugars and for bagasse. Sugarbeet fiber is too valuable as a cattlefeed to be considered for fuel and chemical production. Subject to further investigation, sweet sorghum shows promise as a source of fermentable sugars and bagasse, as a means of extending the processing season, and as a means of extending the processing season, and as a means of extending the geographical area in which sugar crops can be grown.

Processing research, development, and demonstration are recommended to produce more energy at sugar-processing facilities. Major unknowns remain in the manufacture of ethanol from sugar crops. A high priority should be assigned to the study of processes for manufacturing ammonia, methanol, and synthetic natural gas from bagasse, in view of the low unit cost of this material.

You can learn more details about this technology by ordering the following report(s). The appropriate NTIS price code is given in parentheses.

TID-22781

(E02)

Order from:
National Technical Information Service
5285 Port Royal Road
Springfield, VA 22161

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Solar Heater for Process Steam

This technical note was based on a report published by the Argonne National Laboratory.

A system has been proposed that employs compound parabolic concentrators (CPC's) to gather solar energy and generate steam for industrial process heat. The system is divided into two loops. Collectors in the collector loop operate a preheater, and collectors in the boiler loop heat water to elevated temperatures. A flash boiler throttles the heated water to steam.

The design uses two types of CPC collectors. In the collector loop, the collectors are fitted with concentric tube receivers. In the boiler loop, the collectors employ heat pipes to transmit heat. This arrangement alleviates scaling and plumbing problems in the boiler loop and allows a fragile receiver tube to be used in the collector loop without danger of rupture. CPC collectors are cheaper to manufacture; since they are not intended to focus sharp images, their mirror reflectors can be fabricated with less precision.

The design is detailed in a report that is divided into two parts. One section presents optical and thermal analyses of CPC's and the heat-pipe design theory. The other section presents the design of the system.

Also, two computer programs have been developed for a detailed analysis of the system performance. They are used to simulate the thermal processes of collectors in both the collector and the boiler loops in the system. The programs are included as appendixes to

this report.

Calculations show that the design is technically feasible. The CPC collector was found to have an efficiency that is only weakly dependent on its operating temperature, making this type of collector particularly attractive in high-temperature applications.

You can learn more details about this technology by ordering the following report(s). The appropriate NTIS price code is given in parentheses.

ANL-79-102
(A06)

Order from:
National Technical Information Service
5285 Port Royal Road
Springfield, VA 22161

For program-related information other than that provided in the report(s) described here, contact:
Kent Reed
Argonne National Laboratory
9700 South Cass Avenue
Argonne, IL 60439

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Shallow Solar Ponds as an Energy Source

This technical note was based on research conducted by the Lawrence Livermore National Laboratory.

The shallow solar pond (SSP) is a solar-energy collector designed to supply large amounts of heat to industry at a cost competitive with fossil fuel. A typical SSP module, evaluated under programs sponsored by the U. S. Department of Energy, consists of a 5-by-60-m plastic bag filled with water to a depth of 100 mm. The bag rests on a layer of insulation and is covered with a fiberglass greenhouse glazing. Under ideal summer conditions in the Southwestern United States, such a module will heat 30,000 liters (8,000 gallons) of water at 15° C to a temperature of 60° C. It will collect up to 3.4 GJ/m^2 per year.

Because the normal output of the SSP is water between 25° C (77° F) and 60° C (140° F), the most ideal applications for SSP are those that can use the water directly, perhaps with a boiler to boost the temperature during the winter months. Such uses include domestic hot water for large residential users (hospitals, dormitories, and barracks), industrial wash water, chemical processing of hot solutions, and feed water for boilers.

Solar ponds could, nevertheless, also be used as sources of heat only, by using a heat exchanger to separate the water from the rest of the system. Typical applications would include space heating, vapor turbines, and heat pumps.

UCRL-52385 Rev. 1

You can find out more about this technology by requesting support package PB80-978641, which is available from NTIS for $10. Prepayment is required. Requests citing the support package number should be directed to:
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5285 Port Royal Road
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For program-related information other than that provided in the support package described here contact:
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FTS 532-1459

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Livermore, CA 94550
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FTS 532-1462

†

Planning for Economical Photovoltaic Power

This technical note was based on a report prepared by Research Triangle Institute for the Sandia National Laboratories.

The economics of photovoltaic power production are assessed in a report concerning photovoltaic generation on the premises of non-residential users presenting electrical loads in the range 25 kW to 5 MW. For various levels of energy consumption, the expected profitability of photovoltaic versus conventional systems is estimated on the basis of current and projected capital and operating costs.

The study goes on to outline the design procedure for several types of systems. Performance and economic models are presented for five selected designs:

1. A dental clinic with a solar-cell array of 65 kW capacity, which produces, on the average, 27 percent of the power required by that facility;

2. A fast-food restaurant with a photovoltaic array and storage system of 400 kWh capacity capable of supplying 40 percent of its annual electrical requirements.

3. A machinery-manufacturing plant with photovoltaic array and 1,500 kWh of storage that supply 54 percent of its annual electrical demand;

4. A 31,400-square-foot (2,900 m^2) shopping center with electrically powered heating and cooling, having a 150-kWp (kilowatt-peak) photovoltaic collector capable of supplying 50 percent of peakload and 13 percent of average annual load; and

5. A high school with a 250-kWp array that provides all the space heating and hot water required, as well as 31 percent of the annual demand.

It appears that photovoltaic power will become economical in increasing numbers of applications if the system costs can be reduced significantly. Increases in system efficiency beyond 20 percent could relax the constraint imposed by system cost.

You can learn more details about this technology by ordering the following report(s). The appropriate NTIS price code is given in parentheses.

SAND-79-7020, Vol. 1
(A04)

SAND-79-7020, Vol. 2
(A10)

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For program-related information other than that provided in the report(s) described here, contact:
Ed Burgess
Sandia National Laboratories
Albuquerque, NM 87185
(505) 844-2178

†

Measuring Resistivity of Photovoltaic Thin Films

This technical note was based on research conducted by the Solar Energy Research Institute.

The resistivity of thin semiconductor films on metal substrates is measured quickly, accurately, and nondestructively by a microwave technique. The new method can be used in manufacturing solar cells, both as a guide to controlling process parameters and as an indication of the performance of the completed cells. For example, in cadmium sulfide/copper sulfide photovoltaic cells, the microwave technique can ensure that an adequate

film of Cu_2S has been deposited on a metal substrate before a CdS film is deposited.

In the new method, which was developed for the U.S. Department of Energy, the thin-film specimen is placed on one side of a microwave resonator cavity. Microwave power at 90 to 94 GHz is fed to the resonator cavity through a gold-plated reflector having a 1-meter radius of curvature. The reflector focuses energy on the specimen. The quality factor Q of the cavity is measured and compared with the Q of the cavity without the specimen. The relation between the two Q values indicates the resistance of the sample.

Previously, it was necessary to attach metal contacts to the film. The new method is not only noncontacting but is also suitable for high-speed automation.

SERI/TR-32-227

You can find out more about this technology by requesting support package PB80-978571, which is available from NTIS for $10. Prepayment is required. Requests citing the support package number should be directed to:
National Technical Information Service
5285 Port Royal Road
Springfield, VA 22161

For program-related information other than that provided in the support package described here, contact:
Steve Hogan
SERI
1617 Cole Boulevard
Golden, CO 80401
(303) 231-1778

†

High-Efficiency Photovoltaic Converter System

This technical note was based on a report prepared by Varian Associates, Inc., for the Sandia National Laboratories.

Photovoltaic conversion efficiencies of 25 to 30 percent, which may make photovoltaic systems more economical, have been reached by dividing the spectrum so that high-energy photons fall on solar cells with high bandgaps and lower energy photons fall on solar cells with lower bandgaps. A report describes the development of the following:

- a high-efficiency optical filter that transmits light with energy above 1.6 eV;
- a silicon, low-bandgap solar cell;
- an aluminum/gallium/arsenide, high-bandgap solar cell;
- a way of packaging the solar cells that make good electrical contact without blocking off most of the incident sunlight.

These experimental units have been combined to give conversion efficiencies of 27 percent at a concentrated intensity of 113 suns and 26 percent at 489 suns, at a temperature of 50° C. Assuming a nominal optical centration efficiency of 80 percent, these efficiencies translate to overall efficiencies of 21.6 and 20.8 percent, respectively.

The high-bandgap cell differs only slightly from the normal GaAs solar cell; its p-n junction is formed in a layer of $Al_xGa_{1-x}As$, where x = 0.2 for a bandgap of 1.65 eV. The conversion efficiency of this cell is not very sensitive to temperature, degrading at a rate of only 2×10^{-4}/°C. The efficiency of the Si cell degrades at 6×10^{-4}/°C; however, only the narrow band of the spectrum between 1.1 and 1.6 eV is reflected onto the Si cell, so most of the absorbed thermal energy is absorbed in the $Al_{0.2}Ga_{0.8}As$ cell. Thus, for use in a total energy (thermal plus photovoltaic) system, relatively-high-temperature heat could be extracted from the high-bandgap cell with little loss of its efficiency, which the Si cell is kept cool.

You can learn more details about this technology by ordering the following report(s).

The appropriate NTIS price code is given in parentheses.

SAND-79-7048
(A05)

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For program-related information other than that provided in the report(s) described here, contact:
Eldon Boes
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†

Designing Solar Ponds

This technical note was based on research conducted by the Solar Energy Research Institute.

Solar ponds are probably the simplest technology available for thermal conversion of solar energy according to a 1979 report published by Solar Energy Research Institute. The physical phenomenon for solar ponds exists in nature although further research and development is needed to improve system performance. Perhaps in a few years a handbook for general use can be developed. The study, "A Simple Design Tool for Sizing Solar Ponds," provides a simple method for determining the required surface area and depth of a solar pond. It describes a base case salt gradient solar pond design and lists steps to determine the required surface area and depth for a pond of this design. The method is used to obtain estimated pond sizes for various locations in the United States with only the base case salt gradient solar pond design being considered. The report outlines a method for the more general solar pond including salt gradient ponds diverging from the base case design and saltless ponds. It provides hints on how to apply the method to a practical sizing problem.

A second report "Salt Concentration Gradient Solar Ponds—Modeling and Optimization" is a 1979 conference paper that discusses a computer simulation program, SOLPOND, for predicting thermal performance of salty ponds. Previous analyses of salty solar ponds had discussed their optical, thermal, and hydrodynamic behavior and developed simplified, closed-form solutions of pond themal performance. In SOLPOND, finite element techniques are employed to model pond thermal performance, and the program is structured to perform discrete time solutions. This approach allows user flexibility because weather and load profiles are handled as discrete data. Additional versatility results from considering optical transmission characteristics of the pond solution as input data.

Simulation studies have investigated numerous performance characteristics and representative results are included. These results illuminate the effects of load, salinity profile geometry, or optical transmission on seasonal response of the pond storage temperature. Additional simulation results evaluate thermal losses through the pond perimeter. A simple method for economic optimization of pond depth geometry is also discussed.

SERI/RR-351-347 and SERI/TP-35-277

You can find out more about this technology by requesting support package PB80-979581, which is available from NTIS for $15. Prepayment is required. Requests citing the support package number should be directed to:
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For program-related information other than that provided in the support package described here, contact:
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(303) 231-1011

†

How Increased Coal Use Will Affect the Midwest

This technical note was based on research conducted by the Argonne National Laboratory.

A study conducted for the U.S. Department of Energy examines the effects of increased coal use in the Midwestern United States. The study considers trends in energy supply and demand; the limitations on the choice of sites for facilities that produce or consume coal; and the effects on water availability, coal reserves, air and water quality, and trace-element emissions. On a more personal level, the study evaluates social and economic impact and health risk. Throughout, coal is regarded both as a primary fuel and as a raw material for synthetic fuels.

The study finds that the increments of pollutant concentrations will not generally exceed air quality standards, except for the 24-hour standard for SO_2. Unless solutions are developed, sulfur emission rates may exceed legal standards. This and general emissions from other existing sources may limit acceptable plant capacities. Although overall water supplies in the 14-state study region are adequate for foreseeable energy requirements, significant water shortages may occur locally.

Coal mining will continue to have a large effect on water quality in smaller streams unless strict controls are maintained. Coal gasification or liquefaction plants may cause local water quality problems, but the nature of the effluent from these plants is still not definitely known.

The socioeconomic effects of new conversion and generating plants could be significant in some localities. The impacts on social patterns, transportation, housing, and other factors will depend upon the particular host community and coal technology and could be mitigated with effective management strategies.

ANL/AA-11

You can find out more about this technology by requesting support package PB80-981071, which is available from NTIS for $30. Prepayment is required. Requests citing the support package number should be directed to:
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5285 Port Royal Road
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For program-related information other than that provided in the support package described here, contact:
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Technology Assessment Division
Mail Stop E-201
Washington, DC 20545
(301) 353-4406

†

Consequences of Greater Coal Use

This technical note was based on research published by the U.S. Department of Energy, Environment, Division of Technology Assessments.

A study conducted by the U.S. Department of Energy assesses the consequences of the increased use of coal called for by the National Energy Plan. It examines the effects of a targeted 80-percent increase in electric-utility use of coal by 1990 (over 1975 levels) and a 300-percent increase in industrial coal use by that time. The assessment covers air quality, health, water quality and availability, solid-waste disposal, local socioeconomic effects.

According to the assessment, air quality, es-

pecially SO_2 emissions, may be the major environmental constraint on reaching coal-use goals, especially where air quality is already poor. Overall, however, the impact of SO_2 emissions on public health will probably be governed more by the increasing population than by the increased use of coal.

Coal will have only a small effect on water quality nationwide, but local problems may arise. The West is expected to have restricted mining due to insufficient water to meet site-reclamation requirements. The Midwest may be faced with restrictions on utility coal plants due to legal constraints and competition with other users for available cooling water. The disposal of ash and sludge should not restrict utility coal use or coal extraction, but may limit industrial use, particularly in urban areas of the Northeast.

Significant socioeconomic effects will be associated with local population increases to support the construction and operation of new coal-related energy facilities, especially in Colorado, Montana, Utah, and Wyoming. Nationally there will be an increased demand for energy-related construction skills, but it currently appears that labor supply will be adequate. Capital investment in the energy sector, estimated at $304 billion in the 1986-to-1990 period, is not expected to burden unduly the availability of capital. The study also points out that increased mining will probably produce a proportional increase in occupational accidents and disease and warns that the increased coal-transportation requirements may produce an increase in transportation-related accidents.

You can learn more details about this technology by ordering the following report(s). The appropriate NTIS price code is given in parentheses.

TID-29425, Vol. 1

(A05)

TID-29425, Vol. 2

(A14)

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U.S. Department of Energy
Technology Assessment Division
Mail Stop E-201
Washington, DC 20545
(301) 353-4406

†

Pumped-Water Energy Storage for Farms

This technical note was based on research conducted by BDM Corp. for the Sandia National Laboratories.

A study for the U.S. Department of Energy investigates the feasibility of using pumped well water for energy storage. A conceptual design for a small pumped-water plant has been developed as part of the study, and the economics of the plant have been analyzed. The plant is suitable for the energy needs of a farm (such as a 30,000-hen chicken farm or 50-head dairy farm) and a dwelling using about 5,110 kWh per month.

Electrical energy from a solar-cell array or a windmill drives a motor that pumps underground water into a storage tank on the surface. When solar or wind power is inadequate, the stored water is allowed to return to the well via a turbine, and the turbine generates electricity. The same motor that drives the pump can be used as the generator. The pump can also serve as the turbine. A synchronous inverter converts the direct current from the solar cells or windmill into alternating current for the pump motor and also conditions the from the turbine generator.

The tank size for a 5-day storage capability is approximately 87 feet (26.5 meters) in diameter and 10 feet (3 meters) deep (or 1.38 acre feet of water). On a single farm, the pumped/storage system can save annually 166 barrels of oil or 24.6 tons (2.2 metric tons) of coal.

You can learn more details about this technology by ordering the following report(s). The appropriate NTIS price code is given in parentheses.

SAND-79-7096

(A05)

Order from:
National Technical Information Service
5285 Port Royal Road
Springfield, VA 22161

†

Flywheel To Store Solar Energy for Homes

This technical note was based on research conducted by William M. Brobeck & Associates for the Sandia National Laboratories.

A household flywheel energy-storage system (FESS) concept, developed in a feasibility study for the U.S. Department of Energy, might make small solar-cell arrays practical and economical. In the FESS concept, solar energy collected by rooftop photovoltaic cells is stored as kinetic energy in a rotating flywheel. On cloudy days and at night this energy is recovered as electricity.

The system, installed, for example, under the garage, would include a motor/generator. During the day, this motor/generator powered by the array would work as an electric motor turning the flywheel. At night and on overcast days, the energy stored in the flywheel would run the motor/generator, working as a generator to produce enough electricity for household needs.

The proposed flywheel has a fiber-composite rotor and operates in a vacuum chamber to eliminate air friction. For economy and minimal bearing friction, the flywheel is supported by magnetic and ball bearings. A hermetically-sealed magnetic power coupling avoids the expense and complexity of a rotary vacuum seal.

The design includes mechanical design (rotor, suspension, shaft, magnetic coupling, motor/generator, and vacuum vessel), electrical design (control system, motor/generator drive, sensor logic, power supply, and inverter), the establishment of subsystem selection criteria, and the optimization of system efficiency, reliability, and safety. The estimated system cost is about $5,000 for a 10-kWh flywheel storage system and about $18,000 for a 50-kWh system, in annual production quantities of 100,000 units.

You can learn more details about this technology by ordering the following report(s). The appropriate NTIS price code is given in parentheses.

SAND-79-7088

(A06)

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†

Saving Energy in Aluminum Industry

This technical note was based on research conducted by the Argonne National Laboratory.

A study sponsored by the U.S. Department of Energy analyzes the fabrication of aluminum products for possible energy conservation, from primary aluminum through finished products. The results, published in a 63-page report, identify melting and heating,

mechanical forming, and alternative processes as areas most promising for saving energy.

For instance, waste-heat loss in melting and heating can be reduced by such simple techniques as keeping the furnace doors shut as much as possible, sealing leaky furnace doors and sightholes, and regular adjustment of burners. Another method is to enrich the burner feed with oxygen, which according to one study reduced the fuel consumption by 21.6 percent. Finally, submerged centrifugal pumps that circulate the melt to increase the heat transfer can raise reverb furnace efficiencies to between 28 and 46 percent.

Recupertors can potentially save 35 percent of fuel used for melting; regenerators, widely used by the steel industry, may be attractive for new installations. Further fuel savings are also possible using induction furnaces. These are 70 to 80 percent efficient, compared to 10 to 15 for typical gas-fired furnaces.

For metalworking, improvements are possible in extrusion by the use of efficient lubricants to reduce friction, indirect extrusion to save 30 to 50 percent of the energy, and by minimizing the die land. Hot extrusion process should be reassessed to see if process temperatures can be reduced.

Continuous casting and powder mentallurgy are shown to be energy-economical processes. Fuel conservation from continuous casting can be about 33 percent; powder processing must be closely compared with diecasting to determine potential savings.

You can learn more details about this technology by ordering the following report(s). The appropriate NTIS price code is given in parentheses.

ANL/CNSV-3

(A04)

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For program-related information other than that provided in the report(s) described here, contact:

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Recovering Energy From Scrapped Tires

This technical note was based on research conducted by the Argonne National Laboratory.

About 75 percent of 200 million annually scrapped tires ends up in landfills. This represents a waste of a small but valuable resource and causes a variety of environmental problems. Whole tires buried in the ground rise to the surface to become a fire hazard as well as a breeding ground for mosquitoes and rats.

In a study, sponsored by the U.S. Department of Energy, this problem was analyzed by evaluating six opportunities that can be used to recover energy from scrapped tires and thus eliminate unnecessary dumping. Scrapped tires can be utilized in (1) combustion by burning them whole or shredded, (2) the combustion of fuels derived from the tires, (3) conversion to chemical feedstock, (4) substitution for virgin rubber, (5) partial replacement for asphalt in road paving, and (6) such miscellaneous areas as in constructing artificial reefs. Each of these opportunities has been analyzed and the amount of net energy recoverable in each computed. The results are published in a 43-page report.

Before any processing, the scrapped tires must be collected and transported to some central location where the processing will take place. This consumes a certain amount of energy, depending on the mode of transporta-

tion, the distance, and whether the tires are shredded or not. The energy expended in shredding may be compensated for by more economical transportation because the tire volume is reduced to 20 percent of the original volume. All of these questions are addressed in the report.

Findings reveal that currently the most promising option is to use scrap tire material partially to replace asphalt in road construction and repair. Even though this approach does not recover the heat of combustion or the embodied energy of the tire, it utilizes the advantage of rubber to make the pavement more durable. The energy savings from less-frequent resurfacing would be about 90,000 Btu/lb (210 kJ/g) of rubber used.

The other options are also promising, but some remain restricted to small-scale applications. Further research is needed to assess their full potential.

ANL/CNSV-5

You can find out more about this technology by requesting support package PB80-981061, which is available from NTIS for $10. Prepayment is required. Requests citing the support package number should be directed to:
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For program-related information other than that provided in the support package described here contact:
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Argonne, IL 60439

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†

Energy Economy in Production of Chlorine

This technical note was based on research conducted by Versar, Inc., for the Argonne National Laboratory.

A study of processes for producing chlorine, sponsored by the U.S. Department of Energy, has found that extraction from sodium chlorine (NaCl) in a membrane cell may be more energy-efficient that the commonly-used brine electrolysis system. Many past and present methods were evaluated on the bases of raw-material availability, the type and amount of energy required, byproduct salability or disposability, and the status of development. The most promising of these processes for chlorine production are:

- the electrolysis of NaCl in a membrane cell,
- the conversion of waste HCl, and
- the oxidation of NH_3CL.

The chlorine industry is the second largest consumer of electricity among all electrochemical industries. In 1977 alone 35 billion kWh of fuel energy were used to power diaphragm and mercury cells for the electrolysis of brine. These cells have an overall efficiency of only 12 percent; thus a more efficient production method, which could save billions of kilowatthours every year, is highly desirable.

The figure shows a cell with NaCl anolyte and NaOH catholyte divided by a membrane that passes only Na^+ ions. This process offers the greatest potential for greater energy efficiency, and further improvements are already projected. The other two processes of possible interest are not feasible; insufficient waste HCl makes its conversion impractical, and the oxidation of NH_3CL is similarly limited by material availability.

ANL/OEPM-79-1

You can find out more about this technology by requesting support package PB80-979571, which is available from NTIS for $15. Prepayment is required. Requests citing the support package number should be directed to:
National Technical Information Service

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Springfield, VA 22161

†

Energy Conservation in the Textile Industry

This technical note was based on reports prepared by Georgia Institute of Technology for the U.S. Department of Energy, Conservation and Solar Energy, Industrial Energy Conservation.

Energy consumption by various processes in the textile industry is analyzed in a study conducted in two phases. Phase I identifies the major energy-intensive processes and estimates their conservation potential, and Phase II considers the development of new or modified processes to save energy. Such dry processes as spinning, knitting, and weaving do not afford much opportunity for energy savings because they require complex equipment that is expensive to modify and because the energy consumed is largely in the form of electricity. However, wet processes use mainly thermal energy, either directly (as in drying operations) or indirectly (as in heating dye liquors).

Data gathered in the study show that about 41 million barrels of oil equivalent energy is consumed by the wet processes. An estimated 12.5 million barrels can be saved by procedural and engineering modifications; so, approximately 31 percent of the wet-process energy consumption (and 19 percent of the total industry energy consumption) can be saved.

The main modifications proposed and investigated are the thermomechanical drying, reuse of dyebaths, combined scour/bleach for material preparation, atmospheric-dye-beck modifications, and improved use of heat exchangers in wastewater streams. The atmospheric dye becks or kettles consume such an inordinate amount of energy because of their inefficient design that they are especially well suited for conservation efforts.

You can learn more details about this technology by ordering the following report(s). The appropriate NTIS price code is given in parentheses.

ORO-5099-T1

(A08)

ORO-5099-T2

(A18)

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†

A Solar Greenhouse for Your Mobile Home

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The solar greenhouse (Figure 1) is devised to be adjacent to the outside south wall of your mobile home. It does not physically attach to the home or deface the structure in any way, but it does link with the home through an existing window. This 12-foot design is appropriate for a typical 14 x 80 mobile home.

The materials for this design cost from $500 to $550 at **1979** prices. You will need some basic tools and carpentry skills before committing yourself to this project. Properly constructed, this greenhouse will provide your mobile home with warmth and your family with fresh flowers and vegetables. It can be transported to a new location, providing that a means to lift it onto a trailer is available.

There are numerous other solar greenhouse designs; you may want to look into them before deciding on this one. Two books devoted to the subject are included in "Sugestions for Further Reading" on page 21: *The Food and Heat Producing Solar Greenhouse* by Fisher and Yanda, and *The Solar Greenhouse Book* by McCullagh. These two books are referred to in the instructions below.

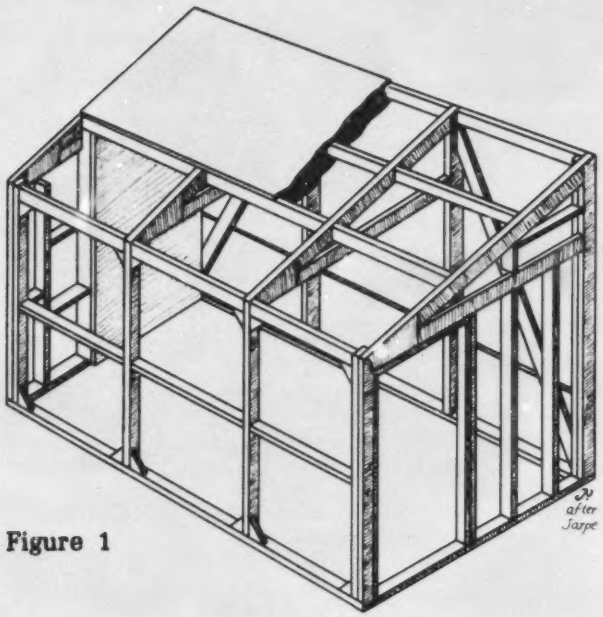


Figure 1

To get started, you will need the following materials:

Item	Quantity
Ready-mix concrete	4 bags
Railroad ties 8′	5
Plywood ½″ × 4′ × 8′ CDX	4 sheets
Wood: 2″ × 4″ × 12′	2
2″ × 4″ × 10′	8
2″ × 4″ × 92-5/8″ (studs)	33
2″ × 2″ × 8′	2
½″ × 1″ × 8′	2
½″ × 1″ × 4′	1
¼″ × 1½″ × 8′	As required
Insulation R-11 22½″ wide	1 roll
Masonite or paneling 1/8″ or ¼″ × 4′ × 8′	4 sheets
Asphalt roofing paper 90#	1 roll
Anchor bolts ½″ × 12″	4
Butt hinges 3″	1 set
Butt hinges 2″	2 sets
Stand-out slide assemblies	4
Lockset	1
Foam tape ½″ wide	2 rolls
Hook and eye latches	3 sets
Nails: 30-penny	1#
16-penny	10#
8-penny	5#
2″ galv. roofing	1#
1″ galv. roofing	1#
Joist hangers 2″ × 4″	4
Staples 1/8″ power	1 box
Water barrels 55 gal.	4
Plastic outside	230 square feet
Plastic inside	220 square feet
Bench and table materials	As desired
Paint, light-colored latex type, exterior grade	

Now, follow these steps:

Step 1. Select a southerly location with at least one large window which will serve as the link between the greenhouse and the mobile home. This location could vary as much as 40° off true south without any appreciable loss of the solar energy heating the greenhouse. The greenhouse should be located where there are no trees or other obstructions which would shade it from the winter sun.

Step 2. Stake out the foundation (dimensions shown in Figure 2). Be sure to leave 1" clearance between the completed unit and the home.

Step 3. Put in a simple foundation to offset uplift loads by the wind and downward loads of the wind, accumulated snow, and the weight of the greenhouse itself. Mix four bags of ready-mix concrete to be placed in each corner, as shown in Figure 2. Each 94-lb. bag is one cubic foot in volume. This is a 12" diameter hole which is 15" deep. Put a 12" long anchor bolt in each concrete piling.

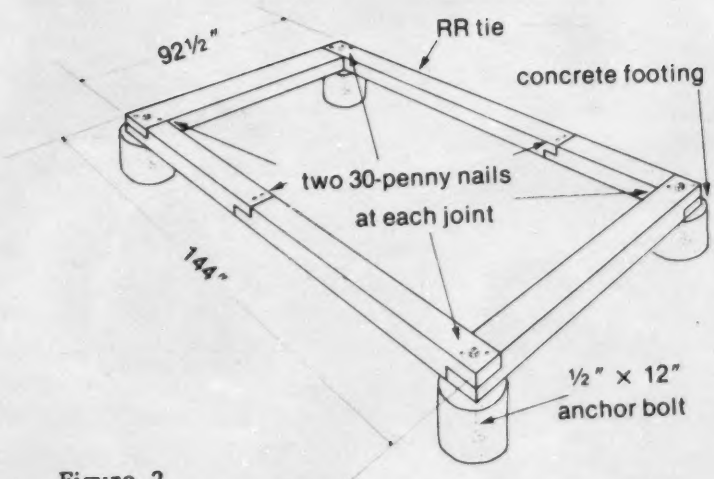


Figure 2

Step 4. Place railroad ties around the perimeter as shown in Figure 2. Notch and spike all joints with 30-penny nails to form overlapping joints in the corners and other locations as required. This is your stem wall. Be sure the ties are covered with earth after the structure is built, since the fumes from the creosote with which they are coated can be injurious to plants.

Step 5. Construct four frame assemblies as shown in Figure 3. You build a frame by drawing the outline on a flat slab of concrete with a piece of chalk, square, tape, and straightedge. Place your two-by-fours on the outline. Overlap the boards where they meet; mark, and saw. When all boards for the one frame are cut, remeasure to be sure your original chalked outline was correct. Nail all joints with 16-penny nails. Now make a pair of truss plates by laying a piece of ½" plywood under the knee of the assembly and mark the outline. The length of the legs of the plate should approximate the dimensions in the drawing. Saw out the plate and trace it onto the plywood for your second plate. Nail the plates onto the fabrication on both sides, using 2" galvanized roofing nails. Make three more identical frames by laying them out on top of the first to be certain that all are nearly alike.

Step 6. Nail the sill plates to the railroad ties, using the actual frame width dimension.

Step 7. Toe-nail the frame assemblies on the front and back sill plates. Be sure the spacing is to the dimensions shown. Cut three 4′ × 8′ pieces of plywood in two pieces 5′ and 3′ long. Nail the 3′ × 4′ panels to the back of the sill plate and trusses as shown in Figure 4. Use the square to be sure that the sill and vertical studs on the assembly are perpendicular. Nail the 5′ × 4′ panels on the top.

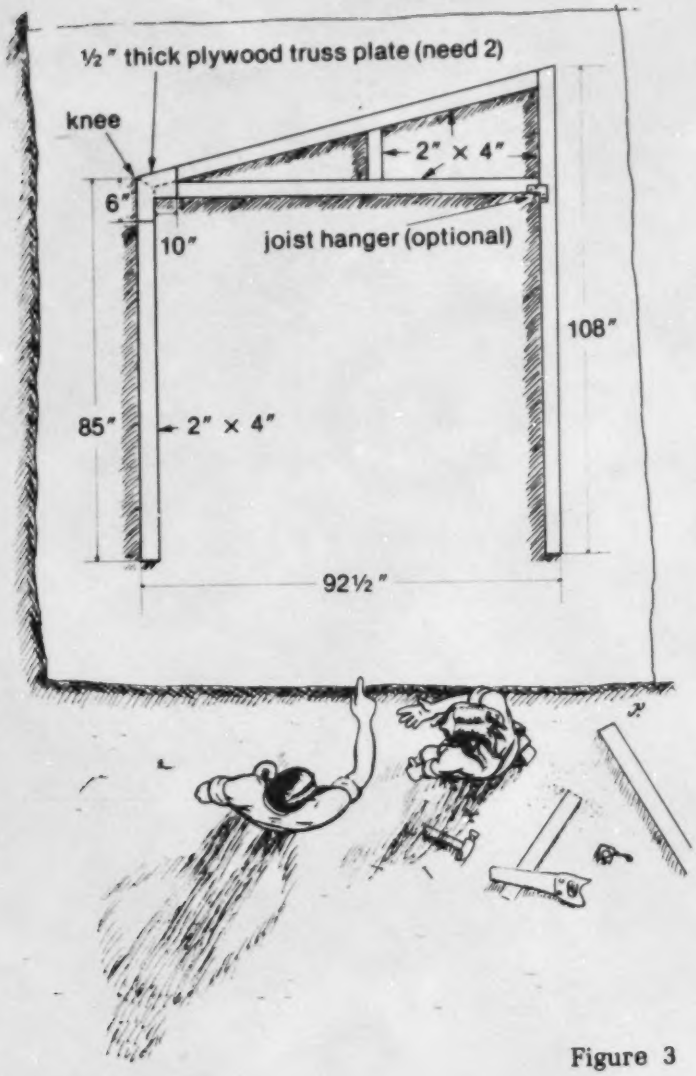


Figure 3

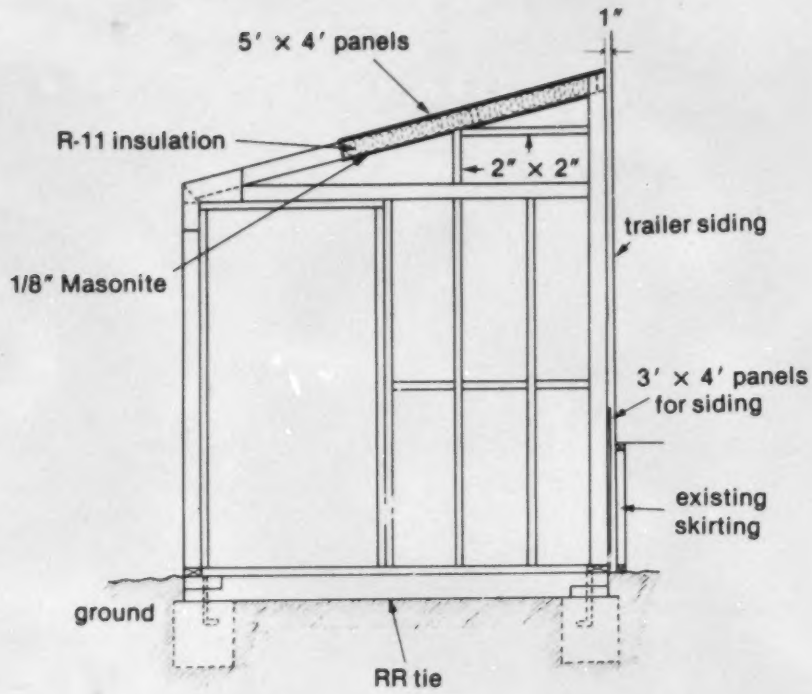
Step 8. The structure is now rigid enough to put in all studs, gussets, blocking, the doorway, and vent frames, as shown in Figures 1, 4, 5, and 6.

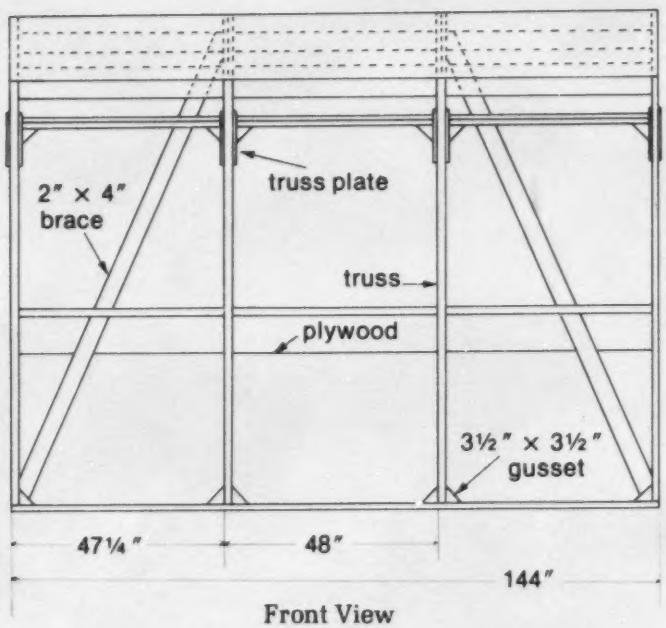
Step 9. Staple the insulation into the roof and the west wall, and cover with Masonite or paneling.

Step 10. Construct the door and the high and low vents as shown in Figures 7, 8, and 9. Attach these components with the hardware specified.

Step 11. You now have the skeleton of your greenhouse. Paint the whole thing before applying the cover.

Figure 4





Front View

Figure 5

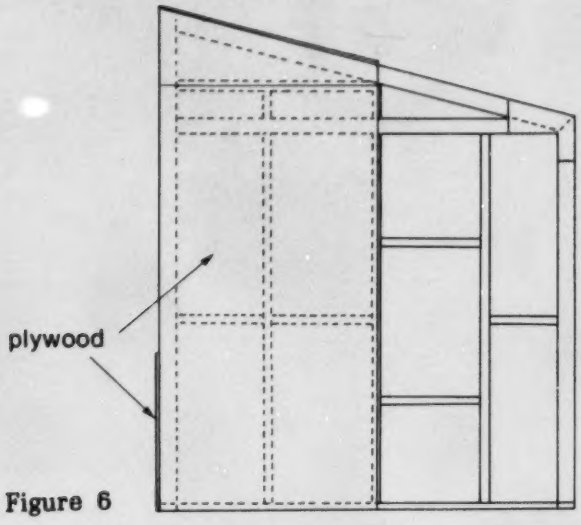
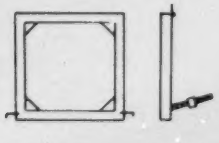


Figure 6

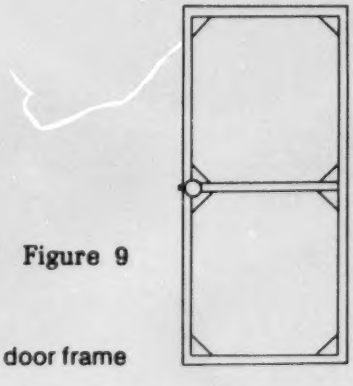
Step 12. You are now ready to put on the skin. Your choices are varied. Almost all plastics—whether clear or opaque, fiberglass, acrylic, polycarbonate, etc.—come in 4' wide rolls. You must decide whether or not you want to see outside from within the greenhouse, and then select the type of plastic. Be sure that the plastic you select is stabilized or inhibited for ultraviolet degradation and has a solar spectrum transmission of around 85% (see the McCullagh or the Fisher and Yanda books for the specifics about this). Also remember to put glazing on the inside to cut your heat loss in half. It is important to seal every crack. No air should be allowed to leak into the structure unless you control it—that's what the vents are for.

Figure 8



low vent

Figure 9



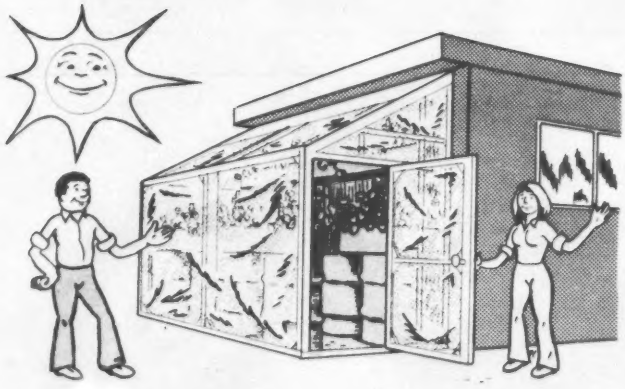
door frame

Figure 7

high vent

Step 13. With the plastic skin in place, you now have a completed greenhouse. What about the seal between the greenhouse and the mobile home? The seal should be a polystyrene bead board strip, cut to the maximum gap width of the space. This material will compress to effectively seal the gap. Notice how warm the inside of the greenhouse is—it will even warm up from diffuse radiation on a cloudy day.

Step 14. Put in your dark-colored, water-filled barrels and then figure out how you want your plants situated. See the Fisher and Yanda book for guidelines.



Suggestions for Further Reading

The books listed here may be obtained from bookstores and libraries throughout New Mexico.

Aaboe, Erik, et al.: *Building Your Solar Greenhouse*, New Mexico Solar Energy Association, 1981.

Eccli, Eugene: *Low-Cost Energy-Efficient Shelter for the Owner and Builder*, Rodale Press, 1977.

Fisher, Rick and Yanda, Bill: *The Food and Heat Producing Solar Greenhouse: Design, Construction, Operation*, John Muir, 1980.

Hand, A. J.: *Home Energy How-To*, Harper and Row, 1977.

Leckie, Jim: *Other Homes and Garbage—Designs for Self-Sufficient Living*, Sierra Club, 1975.

McCullagh, James C., ed.: *The Solar Greenhouse Book*, Rodale Press, 1978.

Time-Life Books: *Weatherproofing*, 1976.

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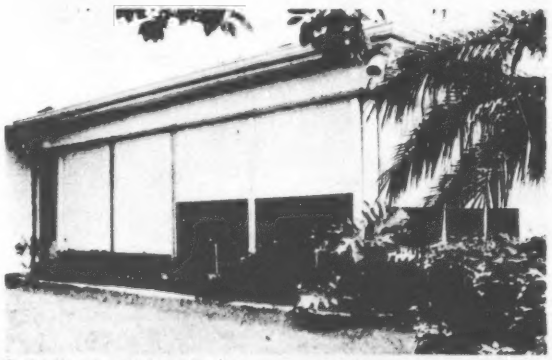
Window Insulation Directory

What's new from the manufacturers; a product guide for window insulations; the choice is yours



Roll-A-Way Interlocking slats

This directory contains product information and sources for

- exterior shutters
- exterior blinds
- interior shades
- interior shutters
- between glazings insulation
- interior glazing panels
- drapes and drapery liners
- insulating fabrics
- window insulation hardware

The directory is the result of a nationwide search conducted by Western SUN (715 Southwest Morrison, Suite 800, Portland, Ore. 97205), one of four regional solar energy centers, which has been developing a comprehensive national passive solar product catalog under guidance from the Department of Energy's passive solar program. Project leader Debbie Allen contacted over 300 manufacturers in compiling materials for the directory. The main emphasis of the search has been to supply builders, architects, designers, and do-it-yourself homeowners with a state of the art reference for passive products. Much of the following information is a result of the research done for Western SUN's catalog. Further researched, organized, and edited by *Solar Age* exclusively for our readers, this special directory will put you in touch with the manufacturers who have the right products for your building or home.

External Shutters

Roll-A-Way interlocking slats are manufactured in various colors. The slats are PVC, and the accompanying hardware can be obtained in aluminum or steel. The shutter has been tested in winds up to 120 mph. R-low.

Roll-A-Way Insulating Shutters. *10597 Oak St., NE, St. Petersburg, FL 33702 (813) 576-6044*

Serrande Shutters are available in wood or PVC, with built-in insulation. They are operated with a simple pulley system that can be manually or electrically driven. The slats on all models are over ½-inch thick, and can span 10 feet. R-medium.

Serrande of Italy, *P.O. Box 1034, West Sacramento, CA 95691 (916) 371-6960*

Pease rolling shutters

Pease rolling shutters are available in PVC white or beige slats and aluminum white or brown hardware. The slats are hollow, and have a limited span of 126 inches. R-low.

Pease Industries, Inc., *P.O. Box 510, New Castle, IN 47362 (317) 529-1700*

Ameroll Rolling Solar Shutters are available in PVC or aluminum hollow slats. They can be operated by pullcord or a no-gear motor-driven shaft. The shutters have an unconditional 5-year warranty against

defects in workmanship and materials. R-low.

Har-El Enterprises, *2804 Northeast 64th Ave., Portland, OR 97213 (503) 282-1836*

Roll-Awn rolling shutters are 9/16-in.-thick hollow PVC slats, with aluminum or steel hardware. Methods of operation include manual, electric, weather, and remote. R-low.

Abox Corp., *629-3 Terminal Way, Costa Mesa, CA 92627 (714) 645-0623*

Rolladen rolling shutters are available in PVC or aluminum slats, with an optional polyurethane foam core injection. The shades can be operated manually with a hand crank or nylon cord, or electrically. R-medium.

American German Industries, Inc., *14601 North Scottsdale Rd., Scottsdale, AR 85260 (502) 991-2345*

Moore Exterior Operable Solar Shades are stress-skinned vertical blades of hollow aluminum, which can be ordered with an insulating core if desired. The blades can be adjusted for maximum daylighting, and closed for insulation. The system is available with optional frames, finishes, actuators, and controls. R-medium, with insulation.

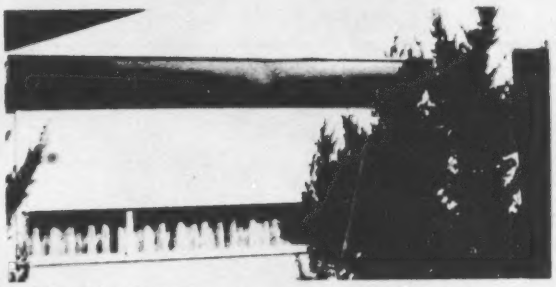
The Moore Company, *800 S. Missouri Ave., Marceline, MO 64658 (816) 376-3583*

Soleil rolling shutters are available in wood or aluminum. The wood options are ramin, douglas fir, or mahogany, in customer's choice of stain, paint, or varnish. The aluminum slats are available painted or anodized. Stainless steel hardware is offered for harsh environments. R-low.

ELR, Inc., *2810 NW South River Drive, Miami, FL 33125 (305) 443-1053*

Reel Shutters are available in six decorator colors, and a combination plastic body with anodized aluminum face, or an all-aluminum shutter for absolute security. The systems come with a one-year free service and three-year parts warranty. R-low.

Reel Shutters, *9517 Chef Menteur Highway, New Orleans, LA 70127 (504) 241-4226*



Roll-Awn rolling shutters

Therma-Roll thermal barriers are constructed of long-lasting extruded plastic. They are custom cut to fit any shape or size opening, with a maximum opening size of 30 square feet to maintain structural integrity. R-low.

Therma-Roll Company, *1531 Hanover, Aurora, CO 80010 (303) 364-3250*

Kommerling Thermal Barriers are available in a variety of different profiled slats, for a range of insulating values, and to fit specific sites. The slat colors are light grey, beige, pearl grey, white, and wood grain. R-low.

Komcraft, Inc., *535 North Midland Ave., Saddle Brook, NJ 07622 (201) 791-1511*

Rollshutters are available in galvanized steel tubing or aluminum tubing reels, PVC slats, or foam-filled aluminum slats. Aluminum or PVC tracks with special sound seals guide the shutter slats from the casing to the sill of the window. R-low.

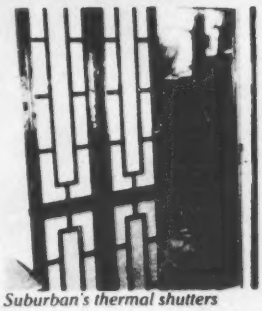
Roll-Up Shutter Co., *Div. of Cedar Cross, Inc., 14157½ Excelsior Blvd., Minnetonka, MN 55343 (218) 935-4353*

Nichols Exterior Solar Control Blinds consist of horizontal aluminum slatted venetian blinds. The slats are held in place with side guides that protect them in winds up to 125 mph. The systems are available with optional time, sun, and wind sensor controls. R-low.

Nichols-Homeshield, Inc., *1000 North Harvester Rd., West Chicago, IL 60185 (312) 231-5600*

The Solarmatic Exterior Window Environmental Control System Model I has non-corrosive aluminum alloy slats and side channels. The units come with combined cord and rod operation to be used manually, or with an electric motor.

Joseph C. Maillard Enterprises, *1233 E. Ramsey St., Banning, CA 92220 (714) 849-3141*



Suburban's thermal shutters

Thermofold bifold shutters are mounted to the exterior of 6-foot sliding glass doors. The panels are made of 1-in. urethane, with ⅛-in. hardboard on both sides. Everything is included in the kits for a complete installation, including fully weatherstripped jambs and tracks. R-high.

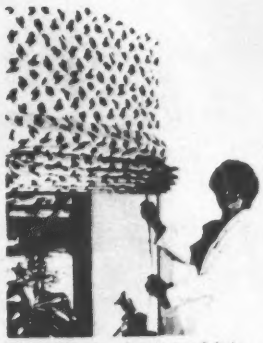
Shutters, Inc., *110 E. 5th St., Hastings, MN 55033 (612) 437-2566*

Internal Shades and Shutters

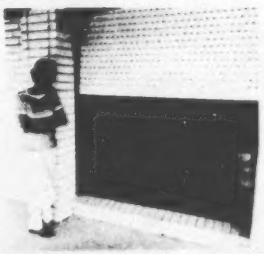
The Windo-Seal is a window shade of 100 percent cotton or fiberglass cloth. A channeling system of extruded plastic guides the fabric from the springless roller, and seals the shade at the sides and bottom. R-low.

Joanna Western Mills, *2141 South Jefferson Street, Chicago, IL 60616 (312) 226-3232*

InFlector shades



Warm Window Insulating fabric



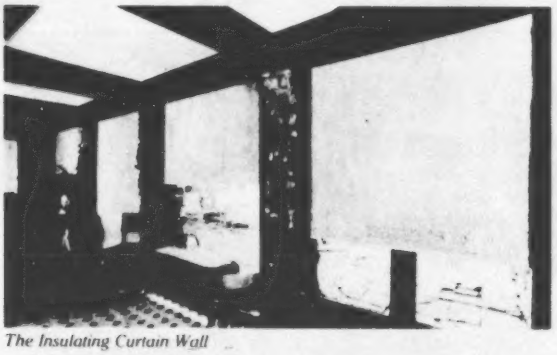
Reel Shutters

Suburban's traditional thermal shutters were designed specifically for retrofitting period buildings. Each shutter is custom designed to match the decor, with a silk-screened or fabric covering. The shutters have a core of ½-in. Thermax, with a ¼-in. plywood face. Edge seals are made with foam weatherstripping.

Suburban Solar Associates, *133 Cherry St., West Newton, MA 02158 (617) 244-1244*

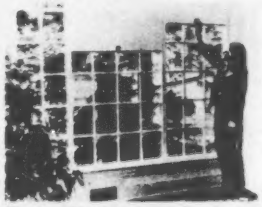
Window Quilt™ is a decorative insulating shade, with ultrasonically bonded layers of polyester-rayon around a center layer of reflective vapor barrier. The fabric is available with perimeter sealing systems of channels or magnetic tape, to be used with rollers, brackets, or pull cords. R-medium.

Appropriate Technology Corp., *P.O. Box 975, Brattleboro, VT 05301 (812) 257-4501*



The Insulating Curtain Wall

Window Warmer



Thermo-Shades

Mecho Shades are a total system for single- or double-layered window shades. The single shade is available in woven PVC, and the double shade has an outer shade of aluminized mylar. Both are available in a variety of colors, with optional side, bottom and top channels. The system can be manual, motorized, automatic, or computerized, and will fit any size window or skylight.

Mecho Shade Corp., *42-03 35th St., Long Island City, NY 11101 (212) 729-2020*

The Insulating Curtain Wall is an insulating shade for passive solar devices that consists of four layers of highly reflective light materials. When in place, the shade self-inflates, causing air spaces between layers. The shade is available in both manual and automated versions, and can cover a maximum area of 20 ft. by 20 ft. R-high.

Thermal Technology Corporation of Aspen, Inc., *600 Alter St., Broomfield, CO 80020 (303) 466-1848*

Warm Window insulating fabric and interior fabric, plus assembly hardware (drapery cord and rings, magnetic tape, etc.) are available through retail fabric outlets and energy conservation equipment retailers. With the company's instructions, do-it-yourselfers with limited sewing experience can make Roman shades. R-medium.

The Warm Window, *8288 Lake City Way NE, Seattle, WA 98115 (206) 527-5094*

Therma-Shades™ consist of an off-white, five-layer, sonic-quilted fabric, sealed around the edges with a magnetic Flex Seal™. Cords are strung on a lock-pulley system to raise and lower the shade. The customer's own fabric can be bonded to the shade on special order. R-medium.

Flexible Thermal Products, Inc., *295 Fifth Ave., New York, NY 10016 (212) 532-3139*

Window Warmer® kits provide insulating material, vapor barrier, hardware, and notions for the construction of their Roman shade. The do-it-yourselfer provides the outer drapery fabric and wood for jamb-hinged clamps to complete the shade. Instructions are provided separately for the construction of the shade. R-medium.

Creative Energy Products, *1053 Williamson St., Madison, WI 53703 (608) 256-7696*

Verosol shades

Sun Quilt motorized track shades are designed for large continuous glazed areas. The fabric is made of an outer layer of cotton/polyester to resist UV, a center layer of hollow-fill fiber, and an inner layer of silver metallized fabric with a urethane vapor barrier. The customer's fabric may be applied with fabric fastener. R-medium.

Sun Quilt Corp., *P.O. Box 374, Newport, NH 03773 (603) 863-2243*

Greenshield Systems are movable blanket insulation systems for heat and light control in greenhouses. A variety of components of tracks and cables are available for different conditions, which can be operated manually or mechanically. R-low.

ADC Greenshield Systems, Division of Automatic Devices Co., *2121 S. 12th St., Allentown, PA 18103 (215) 797-6000*

NRG Shields are retractable transparent, bronze-tinted, metallized mylar shades, which are available in five different methods of installation. Methods vary with the type of edge-sealing technique employed and the means of operation. R-low.

NRG International Corp., *Main and River Road, Tullytown, PA 19007 (215) S-H-I-E-L-D-S*

Thermo-Shades™, which consist of rigid PVC extruded slats sliding in matching PVC tracks, are custom-made for each order. The side tracks are fastened to the window jamb with adhesive foam. The slats interlock for an airtight and watertight seal. R-medium.

Systems for Energy Conservation, *251 Welsh Pool Rd., Lionville, PA 19353 (215) 644-9017*

Solara Roman shade kits are available in four different levels of completion, from complete do-it-yourself to ready-to-hang. The ¼-in. thick material is composed of insulation, vapor barrier, and reflector, and is totally washable. Side seals are made with magnetic tape or fabric-covered, spring-hinged clamps. R-medium.

Chenoa Ltd., *47 Main St., Holyoke, MA 01040 (413) 536-0751*

In'Flector shades are made of a film with Mylar on one side and a heat-absorbent layer on the other. In winter, the Mylar side faces the living area, to reflect heat back into the space, while the absorbent side conducts the sun's heat into the space. In summer, the shades are reversed to reflect the sunlight. The shades are 30 percent transmittent, and are sealed around their perimeter with Seal and Hook Strips. R-low.

Chemstyle, Inc., *5801 W. Mt. Hope, P.O. Box 16070, Lansing, MI 48901 (517) 322-2010*

Minute Man Inside Storm Window Shades are 6 mil PVC sheets on rollers, available in three standard sizes. The sheets are attached to a roller, and are pulled down and sealed to a differential release tape mounted around the window trim. The kits come complete with the hardware necessary for installation, and a limited one-year warranty. R-low.

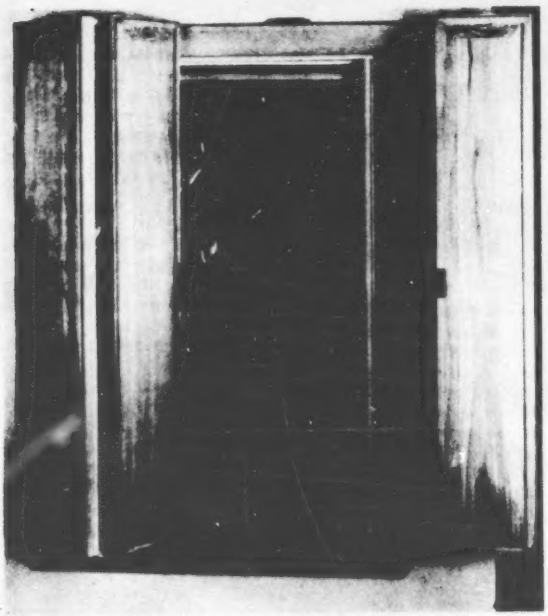
HMS Hauman Marketing Services, *P.O. Box E, Guilford, CT 06437 (203) 453-6551*

Insealshaid is a thermosiphoning air system and combination insulating winter/reflecting summer shade. Thermostatically controlled valves allow air flow between the clear center shade and the inner collector—plate shade. In summer, the plate shade is lifted, and the outer mylar protective shade is lowered. R-high.

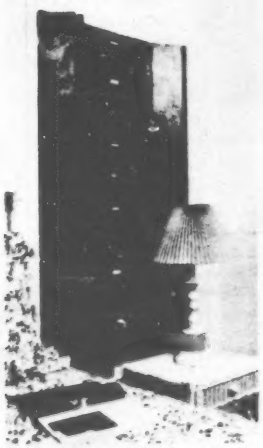
Ark-tic-seal Systems Inc., *P.O. Box 428, Butler, WI 53007 (414) 276-0711*

Verosol shades are permanently pleated polyester with aluminum bonded to the outside. The material is shear enough to allow views to the outside, yet let the sun filter through. No provisions are made to seal the shade around the perimeter. R-low.

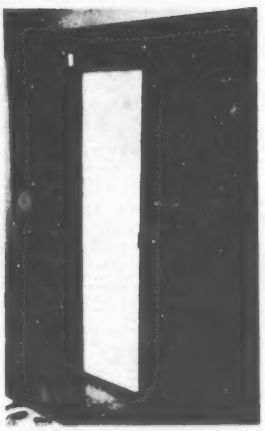
Verosol USA, Inc., *P.O. Box 289, Princeton, NJ 08540 (609) 921-6300*



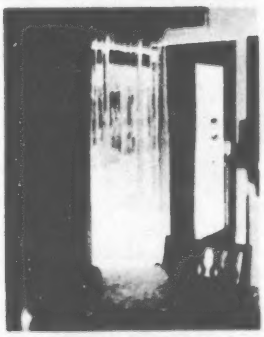
Thermanel Insulated shutters



Therma-Shutter bifold panels



InsulShutters



The Sunergy louver drape

Sure Shades are made of thermo-weldable fiberglass yarn coated with Plasticol. The open weave of the fabric filters out light but allows an outside view. May be installed on the exterior or interior. No provisions are made to seal the shade around the perimeter. R-low.

Sol-R-Veil, Inc., *635 West 23rd St., New York, NY 10114 (212) 924-7200*

The Sunergy louver drape uses a series of metal vanes that are designed with a solar selective coating with high absorptance and low emittance properties on one side, and a high reflective finish on the other. When assembled, the vanes form small chimney spaces that aid in heating in the winter and cooling in the summer. R-medium.

Sunergy Solar Products, *P.O. Box 643, 48780 Eisenhower Drive, La Quinta, CA 92253 (714) 564-4823*

Thermanel insulated shutters are available in four styles: raised wood panel, recessed wood panel, with fabric inserts, or ready for the customer's fabric inserts. The bifold panels are installed with a wall mount system, and come large enough to fit sliding glass doors. R-high.

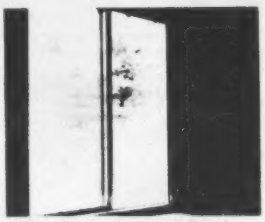
Neilson Company, *Route 1, Foreside Mall, Falmouth Foreside, ME (207) 781-2160*

InsulShutters™ incorporate a polyurethane core inside a birchwood outer surface, lined with metal foil. The bifold panels are sealed with weatherstripping and tongue-and-groove construction. InsulLights are available for skylights, with optional motor and control kits. R-high.

InsulShutter, Inc., *P.O. Box 338, Silt, CO 81652 (303) 876-2743*

Therma-Shutter™ bifold panels are made of birch plywood laminated to an aluminum foil-backed urethane core. They are available in 330 standard sizes, or can be ordered custom-made, complete with hardware for mounting on gypsum or wood-trimmed jambs. R-high.

Wallrich, Inc. *2601 E. Missouri, El Paso, TX 79903 (915) 566-9426*



Selbru Sliding Insulated Panels

Thermi Shutters are folding window or door insulating panels of foil-faced polyisocyanurate encased in clear pine, knotty pine, or luan. The bifold panels can also be ordered in mahogany, cherry, birch, and other woods, or can be covered with fabric. The shutters are available with a full frame to cover or replace existing casing, and can be mounted inside or outside the jamb.

Vermont Therml Shutter Inc., *R.D. 2, Woodstock, VT 05091 (802) 457-1621*

Sun-Mover™, the Insulating Louver, was designed for the more difficult task of insulating sloped glazing. Its adjustable louver angle allows for directional light control for maximum daylighting. The louvers are adjustable with a microprocessor computer which is compatible with photoelectric cells, timers, heat switches and manual switching. R-medium.

Solar Technology Corporation (SOLTEC), *2160 Clay St., Denver, CO 80211 (303) 455-3309*

Wovoak bifold shutters have an interior core of polyurethane insulation, an exterior face of white plastic-coated hardboard, and a woven red oak lattice interior face. All the units are custom-made, and come complete with solid oak frames, prehung in an oak box. R-high.

FTR Wovoak, *5725 Arapahoe, Boulder, CO 80302 (303) 449-7893*

The SunSaver™ shutters are constructed of pine frames, sandwiched between reflected board stock, forming a ¾-in. dead air space. The panel is then covered with a fabric of the consumer's choice. The kits come in three standard sizes, which are cut to fit by the consumer. R-medium.

Homesworth Corp., *18 Main Street, Yarmouth, ME 04096 (207) 846-9934*

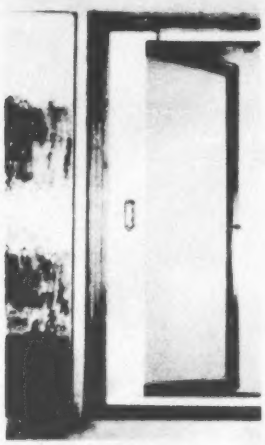
The TS-101 Shutter System is a window/shutter that fits into a

newly constructed 2 x 4 stud wall. At night, the shutter is pulled out of the wall to cover the window. The unit comes with the double-hung window, insulating panel, and panel envelope, plus all the components necessary except standard window trim. R-high.

Aardvark & Sun Solar Inc., *167 Webbers Path, West Yarmouth, MA 02673 (617) 394-6391*

Skylids are aluminum-faced reflective/insulating louvers for skylights, that open and close in response to the sun. The shutters are available with two types of insulating cores, and a variety of finishes. All components are supplied for a complete installation. R-high.

Zomeworks Corp., *P.O. Box 25805, Albuquerque, NM 87125 (505) 242-5354*



The Sunflake window unit

The Sunflake window unit is a combination window and horizontal sliding insulating panel. Installed in new construction, the panel is concealed in a pocket in the wall when not in use. The windows are available in single- or double-glazed casement, awning, or fixed units. R-high.

Sunflake Window Company, *Box 28, Bayfield, CO 81122 (303) 884-9546*

Thermalon interior shutters come in Standard, which have a factory-laminated face of white vinyl film and a reflective white-painted back surface; and Decorator, which have a factory-laminated face of embossed needle-punched modacrylic fabric. The framing system is partially concealed, and comes in hot-dipped galvanized steel, aluminum, or PVC. R-medium.

Armstrong, *Liberty St., Lancaster, PA 17604 (717) 397-0611*

Selbru Sliding Insulated Energy Panels are sliding shutters of 1-in. polyisocyanurate insulation. The panels are foil-faced on both sides, and covered with a layer of 1/16-in. Formica on the front and back. All the molding and framework is extruded aluminum. R-high.

Arrow United Industries, *707 Concourse Village West, Bronx, NY 10451 (212) 993-3600*

Between Glazing Devices

Beadwall self-insulating window panels are double-glazed windows which become insulated as white foam beads are sprayed into the dead air space. A remote motor/blower returns the beads to storage cannisters when the insulation is not desired. R-high.

Zomeworks Corp., *P.O. Box 25805, Albuquerque, NM 87125 (505) 242-5354*

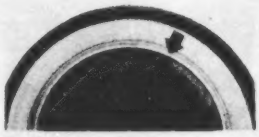
Pella Slimshade® is available in Pella double-glazed windows. Slimshades are narrow slat venetian blinds that fit into the 13/16-in. air space between the panes. R-low.

Rolscreen Company, *102 Main St., Pella, IO 50219 (515) 628-1000*

Interior Glazing

Qualex, a double-walled polycarbonate glazing, comes in kits for do-it-yourselfers or made to order for industrial applications. The sheets come complete with rubber gaskets and hardware, in clear or solar bronze. They may be mounted on the inside or outside of a window. R-medium.

Structured Sheets, Inc., *196 E. Camp Ave., Merrick, NY 11566 (516) 546-4648*



Defender-1

Defender-1™ single-glazed interior storm windows are made of rigid acrylic. Edge designs include the Easy-Open™ magnetic seal, or the Super Lock™ snap-lock seal. Edges are available in white or brown. R-low.

Defender Energy Corp., *P.O. Box L, Dept. S, Mahopac, NY 10541 (914) 628-4488*

Magnetite glazing panels are 100 percent Plexiglas® acrylic with brown or white ABS polymer frames. A continuous magnet in the frame fastens to the continuous magnetic bronzed-steel strip that is fastened to the window trim. The panels are single-glazed, and are 92-percent transmittent. R-low.

Viking Energy Systems, Inc., *275 Circuit St., Hanover, MA 02339 (617) 871-3180*

Wind-O-Gard acrylic panels are available with black, white, brown, bronze, or natural finish aluminum frames. The system of single glazing is 92-percent transmittent, and is available with an optional warm weather screen. R-low.

Hadco Home Improvements, *Nine East St., Boston, MA 02111 (617) 426-7890*

In-Sol double-walled polypropylene panels are ¼-in. thick, with an off-white opaque appearance. The panels are designed for do-it-yourselfers to cut and edge with plastic frames. The panels are 76-percent transmittent. R-medium.

Energy Industries, Window-Solar Shutter Division, *2010 No. Redwood Dr., Route 1, Independence, MO 64050 (816) 257-1919*

Flexigard insulating window kits contain all the materials necessary to build interior glazing panels on site. Flexigard film is lightweight, shatterproof, and weather resistant for exterior installations as well. Kits include film, aluminum frames, tape, and hardware. R-low.

Energy Control Products, 3M, *Bldg. 220–E, SE 223-2W 3M Center, St. Paul, MN 55144 (800) 328-1300 Attn. Dr. Judge King*

Thermatrol custom-made interior-mounted windows are constructed entirely of acrylics. The glazing is clear or bronze-tinted Plexiglas®, and the framework design allows access to the prime window for maintenance purposes or for ventilation. R-low.

Thermatrol Energy Systems, *50 East Spruce Street, Perkasie, PA 18944 (215) 257-6581*

Vikalite is a pressure-sensitive, self-adhering, cellular honeycomb film for commercial and industrial applications where visibility is not critical. The film is cut and applied directly to the window for a permanent installation that is said to have a service life of 10 years, and a transmittance of 80 percent. R-low.

Viking Energy Systems Co., *275 Circuit St., Hanover, MA 02339 (617) 871-3180*

Magnetic seal works like a refrigerator door, using a magnet-to-magnet seal to fasten acrylic glazing to the inside window frame. Custom sized to fit virtually any window, the units can be ordered large enough to cover patio doors.

Magnetic Seal, Inc., *130 South Elkhart Ave., P.O. Box 547, Elkhart, IN 46515 (219) 293-0505*

Fabrics and Hardware

Energy Shield 200 fabric is made from vinyl-coated polyester scrim, with a reflective metalized side. Current use is in thermal liners for air-supported fabric structures and for drop ceilings in skating rinks. R-low.

Roche Industrial Fabrics Ltd., *8118 Third Ave., Brooklyn, NY 11209 (212) 238-0500*

Llumar insulating window shade material is made from a combination of metalized, UV-treated polyester film and spunlaced polyester fabric. It is available in bronze light-filtering, and silver room-darkening, with a choice of white or beige fabric. Current use is in window shades and solar greenhouse shades. R-low.

Roche Industrial Fabrics Ltd., *8118 Third Ave., Brooklyn, NY 11209 (212) 238-0500*

Wind-N-Sun Shield drapery liners

Insa-Lume high energy fabrics are a complete line of laminated reflectorized Mylar polyester films backed with vinyl PVC films, knits, and polyester felts or urethane foams. Fabrics can be added to make insulating shades and energy barriers. R-low.

John Boyle & Co., *112-114 Duane St., New York, NY 10007 (212) 962-4770*

WindowBlankets are a quilted drape of Dupont Dacron® Hollofil® polyester, and Roc-lon® cotton lining which repels water and resists fading. The drapes are available in white, tan, or rust, and are treated with fabric protecting Scotchguard®. R-low.

WindowBlanket, *107 Kingston St., Lenoir City, TN 37771 (615) 986-2115*

Wind-N-Sun Shield drapery liners come in 100-percent Blackout and 87-percent opaque Dimout styles. A third material, called Reversible Piggy-Back Wind-N-Sun Shields, has a foil coating on one side to face into the living space in winter, and can be reversed to face out in summer. Side seals on all three styles are made with Velcro weatherstrip tabs, which are supplied with the liners. R-low.

Wind-N-Sun Shield, Inc., *P.O. Box 2504, Indian Harbor Beach, FL 32937 (305) 777-3558*

Simtrac fabrics were formulated for greenhouse environments to resist UV degradation and mildew. The fabrics are available in varying degrees of shading and heat retention ability. Materials include polyester, vinyl, and Mylar. R-low.

Simtrac, Inc., *8243 N. Christiana, Skokie, IL 60076 (312) 679-7970*

Foylon is a fabric of aluminum foil sandwiched between two layers of polyester. Available in 54-in. widths, the material is porous, permitting moisture evaporation. Foylon is electrically conductive; heat-, radar-, and light-reflective. R-low.

Duracote Corp., *350 North Diamond St., Ravenna, OH 44266 (800) 321-2252*

Polarguard continuous filament polyester fiberfill fabric is compressible for easy storage, yet fills out to the same insulating value of fiberglass when free. It does not require excessive quilting and will not shift, lump, or mat. R-medium.

Reliance Products, *1614 Campbell St., Oakland, CA 94607 (415) 893-7687*

Roc-lon "Metalon" window insulating fabrics are combinations of polyester, aluminum, and foam, and range from light-admitting to black-out materials. Available from window shade manufacturers, and curtain and drapery manufacturers, the materials meet all the federal and state requirements for flammability and smoke toxicity. R-low.

Rockland Industries, *Brooklandville, MD 21022 (301) 823-3770*

The Energlaze frame is designed for attachment to virtually all types of windows, with consumer's choice of glass, acrylic, or vinyl glazing. The vinyl molding allows for interior or exterior installations.

Emersaver Products, Inc., *Greenwood Plaza Floor Three, 5680 South Syracuse Circle, Englewood, CO 80111 (303) 740-7332*

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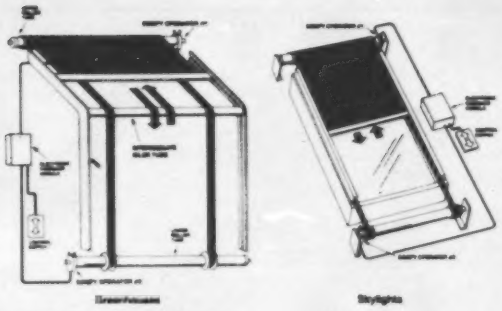
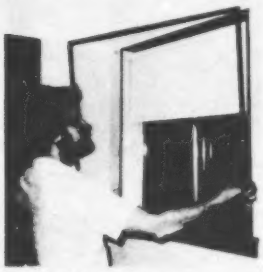


The Somfy Fabric Tension System



The Grabber System

Nightwall Clips are comprised of flexible adhesive-backed magnetic strips and adhesive-backed metal strips, used to attach movable insulation to a window. The magnetic strip is attached to the insulation, and the metal strip is attached to the window or trim.

Zomeworks Corp., *P.O. Box 25805, Albuquerque, NM 87125 (505) 242-5354*

Insul-Trac shade hardware are PVC tracks for do-it-yourself shade installations. The tracks come in 2-, 3-, 4-, and 6-foot lengths in extrusions for flush mounts, inside-trim mounts, and skylights, for use with any type of fabric.

Plum Industries, Inc., *P.O. Box 14, Delta, OH 43515 (419) 822-5899*

Titanseal™ interior Storm Window extrusions are made of high grade ABS polymer, which magnetically seal to a permanent steel strip fastened to the window frame. The extrusions are made for use with acrylic sheet.

Magnetic Interior Storm Window Corp., *14 Ames St., Dedham, MA 02026 (617) 326-8092*

The Somfy Fabric Tension System consists of two motors mounted in parallel roller tubes, which reel and unreel window insulation or shading fabrics. The module can be operated by a switch or controlled automatically with a sun and wind sensor.

Somfy Systems, *1445 Raritan Rd., Clark, NJ 07066 (201) 382-4650*

Wind-N-Sun Shield patented hardware for roller shades have reversible brackets that allow the aluminized side of a shade to face outward in summer, and inward in winter. The weatherstrip side hinges clamp over the side edges of the shade when it is drawn. A felt strip across the top of the window compresses the shade for a better seal.

Wind-N-Sun Shield, Inc., *P.O. Box 2504, Indian Harbor Beach, FL 32937 (305) 777-3558*

The Grabber System of magnetic framework for the installation of interior glazing is composed of rigid PVC. The molding is UV stabilized to prevent deterioration or warpage, and is backed with a strip of flexible magnet. The magnet is drawn to a steel strip that is backed with a double-coated foam adhesive and attached to the frame of the window.

Innovations Unlimited Inc., *77 Cedar St., Babylon, NY 11702 (516) 422-3925*

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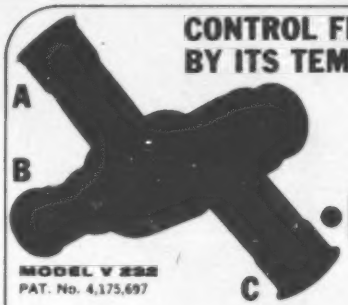

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